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Detailed Case Studies of Summer Ozone Events in Southern Louisiana

Radian Corp, Austin, TX

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DETAILED CASE STUDIES
OF SUMMER OZONE EVENTS
IN SOUTHERN LOUISIANA

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16. ABSTRACT

Three case studies of one to two days duration have been chosen from a three-month data set (July 17 to October 17, 1976) to provide a detailed investigation of the relationship of weather events - especially transport - to the distribution of ozone in southern Louisiana. These case studies show evidence of increased ozone levels downwind from Baton Rouge, with a similar but less noticeable effect downwind from New Orleans. In addition, poor atmospheric ventilation appears to be linked with higher ozone levels and large shower areas with heavy cloud cover were observed to be associated with low ozone levels. Finally, two sites near the coast showed a slower decline from high ozone levels compared to inland sites, when the air with high ozone had arrived from offshore.

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EXECUTIVE SUMMARY

Three case studies of one to two days duration have been chosen from a three-month data set (July 17 to October 17, 1976) to provide a detailed investigation of the relationship of weather events - especially transport - to the distribution of ozone in southern Louisiana. Maps showing weather and ozone were plotted for each hour of the day from 7 am CDT until all of the sites had dropped below 80 ppb ozone. These maps have been analyzed for the ozone distribution and trajectories have been plotted to detect the influence of potential local and long range precursor sources on the observed ozone distribution. The influence of shower areas and air stagnation potential on the ozone levels has also been evaluated.

The results of these case studies indicate that heavy local emissions of ozone precursors in the Baton Rouge area cause a pronounced increase in the ozone levels at nearby sites downwind, and a lesser, but noticeable increase of ozone at sites up to about 45 miles downwind, with abundant sunshine. Similar effects of precursor sources in the New Orleans area could not be determined except for long distance (about 30 miles) downwind because of unfavorable prevailing winds.

Ventilation appears to regulate the intensity of the ozone increase, with poor ventilation favoring high ozone and good ventilation favoring lower ozone. Also, large shower areas with heavy cloud cover were observed to be associated with low ozone levels. Finally, two sites near the coast showed a slower than normal decline from high ozone levels when the air with high ozone had arrived from offshore.

1.0 INTRODUCTION

Ozone was monitored on a continuous basis under contract to EPA by Radian Corporation at nine sites in southern Louisiana from July 17, 1976 through October 17, 1976 (see Figure 1). From this data sample, three cases were selected for detailed study to highlight some of the extremes found in the data set. The first case, August 25-26, covers two days with widespread high ozone measurements, including the highest ozone measurement from the entire data set. The second case, September 16, was selected as the best example of a sunny, light wind day without very high ozone (greater than 120 ppb). Finally, the third case, September 8-9 provides two examples of ozone levels remaining above 80 ppb well after sunset, as well as further examination of widespread high ozone. In addition, ozone data from six Texas Air Control Board continuous monitors in southeast Texas is presented in conjunction with the Louisiana data for each case study.

It should be noted that NO_x and NO measurements from the three month monitoring program have not been examined as a part of these case studies. This NO/NO_x data is available from the EPA. However, hydrocarbons were not monitored as a part of this program, and thus hydrocarbon data is not available from the sites used in this study.

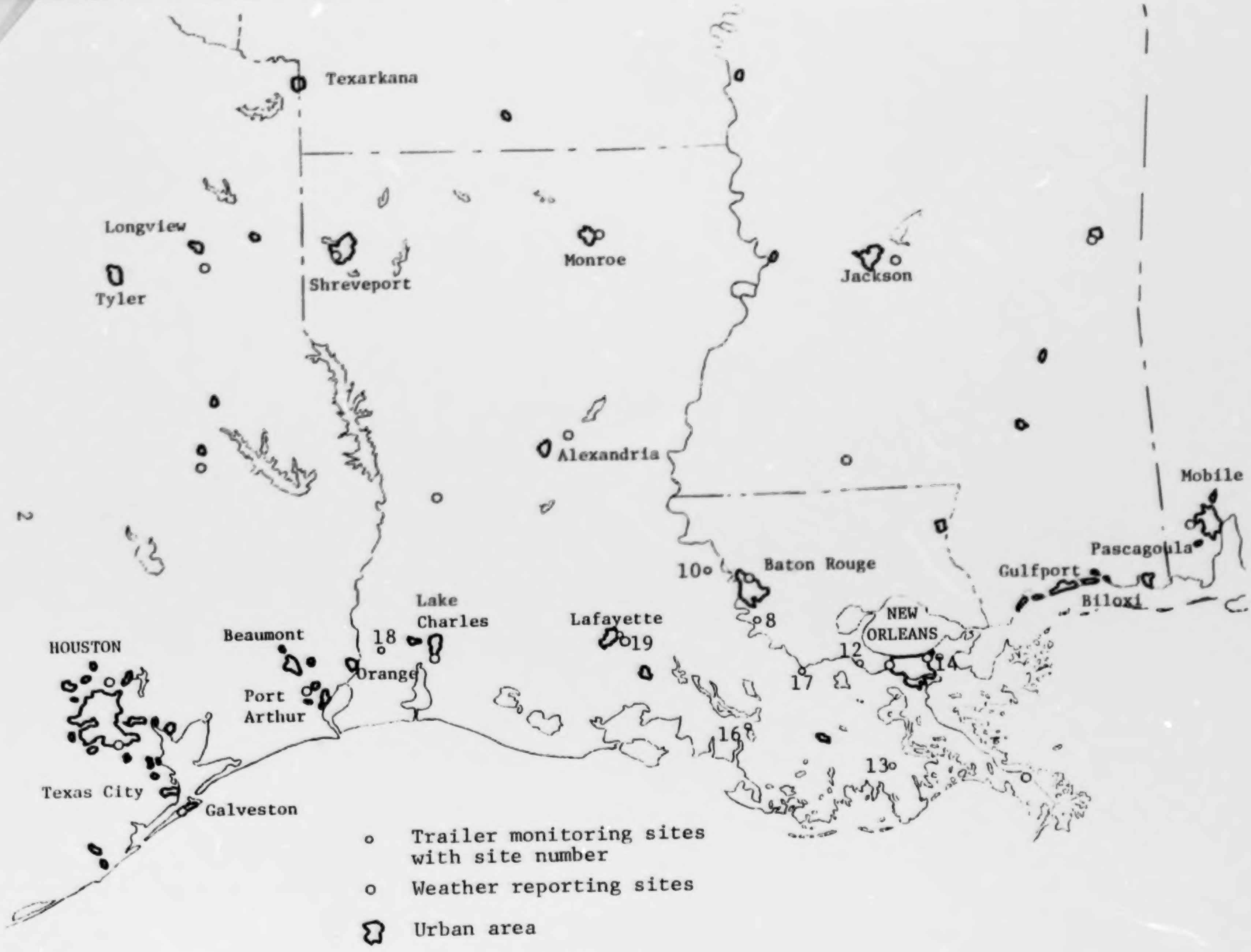
Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
10
Baton Rouge
8
NEW ORLEANS
12
14
17
13
16
Lake Charles
18
Lafayette
19
HOUSTON
Beaumont
Orange
Port Arthur
Texas City
Galveston
Trailer monitoring sites with site number
Weather reporting sites
Urban area

Figure 1

2.0 CASE I - AUGUST 25-26, 1976

A weak trough of low pressure oriented from northwest to southeast across Louisiana was the predominant weather pattern in the region on August 25-26, 1976 (see Appendix A). However, a well defined sea breeze (day) - land breeze (night) regime persisted along the coast in southwestern Louisiana and southeastern Texas. The weak trough line moved slowly westward across Louisiana during the period. Scattered thundershowers occurred behind the trough in Mississippi with a few isolated thundershowers ahead of the trough in northwestern Louisiana and northeastern Texas on the 25th. Also, skies remained cloudy most of the day in southwestern Louisiana, but abundant sunshine prevailed in southeastern Louisiana. On the 26th, a large area of heavy cloud cover and scattered thundershowers spread westward across Louisiana behind the weak trough line. As a result, the New Orleans area was covered with heavy clouds and intermittent thundershowers throughout the day, while the Baton Rouge area had increasing cloud cover and late afternoon thundershowers. Southwestern Louisiana and southeastern Texas remained clear to partly cloudy during the day. Marginally bad to poor air stagnation conditions prevailed away from the shower areas on both days. The poor ventilation (generally 3,000 to 5,000 m^2/sec)[1] was mainly due to very light wind speeds (transport winds generally 2.5 to 3.0 m/sec). The peak mixing heights ranged from about 1,600 meters at sites near the coast on both days up to about 2,200 meters at Baton Rouge on the 25th and up to about 2,000 meters at Baton Rouge on the 26th (before thundershowers moved into the area).

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[1] Ventilation is the product of mixing height and transport wind - mixing height is the height above the ground to which strong vertical mixing takes place due to thermal or mechanical turbulence, while the transport wind is the average wind speed in the mixed layer.

Ozone Distribution

Hourly ozone averages are plotted and analyzed in Appendix B for each hour from 7 a.m. to 7 p.m. CDT on August 25th and 26th. Several sites in Louisiana had exceeded 80 ppb by 10 a.m. CDT on the 25th. All the Louisiana sites continued to rise during the morning and peaked between 2 p.m. and 4 p.m. A large patch of high ozone (greater than 120 ppb) persisted from 11 a.m. to 6 p.m. south of Baton Rouge, with a peak reading in this area of 168 ppb at Trailer 8 for the hour ending at 3 p.m. CDT. All of the sites reported peak readings greater than 80 ppb. However, ozone levels remained generally lower at Trailers 12 and 14 near New Orleans than elsewhere, until a sharp rise occurred around 3 p.m. at Trailer 12 just west of New Orleans. The measured ozone levels dropped below 80 ppb at all sites after 7 p.m. on the 25th.

Two sites had again passed the 80 ppb mark by 10 a.m. CDT on the 26th, and again a large area of high ozone (greater than 120 ppb) persisted for several hours to the south and west of Baton Rouge. The highest ozone reading of 211 ppb for the day and for the entire three-month monitoring period occurred at Trailer 10 just west of Baton Rouge from 1 to 2 p.m. CDT. The ozone levels remained well below 80 ppb in the New Orleans area, most likely because of the heavy cloud cover and increased dispersion caused by thundershowers in the area throughout the day. As this shower area progressed westward during the day, the ozone levels dropped simultaneously, suggesting that low ozone levels (less than 80 ppb) were associated with the air mass influenced by this shower area. Trailer 19 near Lafayette was the last site to drop below 80 ppb - by 6 p.m., just before the onset of a thundershower.

Ozone Transport

Surface trajectory analysis on the 25th (see Appendix C) shows that at 11 a.m. and 3 p.m. at seven sites, the air arriving at only two of the sites had lingered in an area of heavy ozone precursor emissions (hydrocarbons and oxides of nitrogen) for more than three hours. Coincidentally, these two sites, Trailers 8 and 17, also had the highest ozone readings of all the sites at 3 p.m. Thus, it appears that local sources may have caused an additional build-up of ozone above the background levels reflected at the other sites. During this same time, from 11 a.m. to 3 p.m., Trailer 12 reported consistently lower readings than any of the other sites. Surface trajectories show that the air arriving at Trailer 12 had passed over the strong HC-NO_x emission area surrounding the site, during the previous one to three hours. This data suggests that the balance of emissions near Trailer 12 may be detrimental to ozone production. However, the ozone level at Trailer 12 jumped from 96 ppb to 158 ppb from the hour ending at 3 p.m. to the hour ending at 4 p.m., despite little change in the overall trajectory direction. The wind velocity did change considerably - from a steady north-northeast at 6 mph to a light and variable 2 mph. This information suggests that the ozone concentration may vary widely over short distances in the vicinity of Trailer 12, possibly as the result of strong emissions of different reactors with ozone at different nearby sites.

Long range trajectories derived from National Weather Service first standard level (FSL) wind reports (generally about 500 to 1000 feet above the ground) for August 25 show that only the air arriving at Trailer 16 may likely have passed over a heavy HC-NO_x emissions area (Baton Rouge) during the previous daytime mixing period (see Appendix D). A check of ozone data reveals that the ozone levels were high (up to 133 ppb at Trailer 8 and up to 158 ppb at Trailer 10) the previous day. So, it is possible that high ozone at Baton Rouge on the 24th may have directly contributed to the high ozone at Trailer 16 on the 25th. The FSL trajectories for the 25th also suggest that Jackson, Mississippi, Birmingham, Alabama, and Memphis, Tennessee, may have contributed to the build-up of background levels of ozone and/or its precursors in the air arriving in Louisiana. The ozone may be transported in high concentrations aloft during the nighttime, above the nighttime boundary layer, and then mixed down to the ground as the mixing height increases during the day. This mechanism is probably responsible for high background levels of ozone in the Louisiana area.

Surface trajectories for August 26 (Appendix C) show again that the sites with the highest readings have trajectory tracks that pass over heavy precursor emission areas, with the noteable exception of Trailer 16. The surface trajectories for Trailers 8 and 10, which both reported ozone in excess of 130 ppb, show a movement of the air from over heavy emissions areas in Baton Rouge and along the Mississippi River south of Baton Rouge. The surface trajectories for Trailer 16, which recorded up to 153 ppb, did not show evidence of having crossed a heavy precursor emissions region. Although the FSL trajectory for that site does suggest that possibly that some of the high ozone in the Baton Rouge area on the 25th may have been carried aloft over night and mixed down to the ground in the Morgan City (Trailer 16) area on the 26th. Trailer 19 near Lafayette reported ozone up to 126 ppb even though neither surface nor FSL trajectories indicated passage of that air over any heavy precursor emissions areas during the previous 24 hours. However, the air mass arriving in the Lafayette area on the 26th had crossed moderate to heavy precursor emission areas in Alabama and Georgia during the previous 48 to 72 hours. So, it is possible that these long range sources may have significantly contributed to the high ozone levels at Lafayette, with some additional increase due to local moderate precursor emissions in the immediate Lafayette vicinity.

The FSL trajectory for the air arriving at Trailer 10 at 2 p.m. CDT, when a high ozone reading of 211 ppb was observed, suggests that moderate precursor sources in the Mobile, Alabama, area may have contributed to the high ozone levels (Appendix D). However, weather reports from the Mobile area on the previous day, as this air was passing through, show that numerous thundershowers and heavy clouds covered the area for most of the day. Therefore, it is unlikely, in light of previous evidence that widespread thundershowers prohibit high ozone build-up, that high ozone was present in the Mobile area on the previous day. Furthermore, the widespread convective activity should have greatly increased dispersion in the area, reducing the chance for any significant transport of precursors from that area to Baton Rouge. So, it appears that much of the build-up of high ozone at Trailer 10 on the 26th was caused by local precursor emissions in the Baton Rouge vicinity.

3.0 CASE II - SEPTEMBER 16, 1976

A very weak high pressure system covered Louisiana on September 16 (see Appendix A). The ill defined high center drifted northeastward from east Texas into southeastern Arkansas during the day. The flow around this high was strongly distorted by a land breeze in the morning and a sea breeze in the afternoon along the Louisiana coast from about Grand Isle westward into southeast Texas. The most pronounced effect from this sea breeze regime was in the Lake Charles area.

Skies were mostly clear over southeastern Louisiana during the day and clear to partly cloudy over southwestern Louisiana. A few scattered thundershowers occurred in southeast Texas and in Louisiana to the west of Alexandria. The wind speeds were generally light at the surface, averaging about three to five mph across southern Louisiana. Likewise, the trnasport winds were generally light at about 3.5 meters per second around Lake Charles and New Orleans and along the coast, but ranging up to about 5.0 meters per second in the Baton Rouge area. The peak mixing heights ranged from about 1600 meters at New Orleans to about 2000 meters at Baton Rouge and Lake Charles. Consequently, the ventilation was generally fair, despite the light wind speeds, ranging from around 6000 m^2/sec in the New Orleans area, up to about 10,000 m^2/sec in the Baton Rouge area.

Ozone Distribution

By 11 a.m. CDT on the 16th, two sites had passed 80 ppb ozone (see Appendix B). These two sites, Trailers 19 and 13, also had the highest hourly averages for the day, with

102 ppb and 113 ppb respectively. The maximum readings were also reached during the same hour, between 3 p.m. and 4 p.m. CDT. Three other sites out of a total of eight reporting ozone also rose above 80 ppb during the day. However, the three sites that did not report over 80 ppb (Trailers 12, 14 and 17) were located near and just to the west of New Orleans. All of the sites had dropped below 80 ppb ozone by 7 p.m. CDT.

Ozone Transport

Surface trajectory analysis (see Appendix C) shows that heavy precursor emissions from local sources most likely had the greatest effect on the ozone level at Trailer 18 near Lake Charles. The trajectory for Trailer 18 shows that the air had remained within the local emissions area for several hours prior to arrival at the Trailer Site. Also, the surface trajectories indicate that the air arriving throughout the day at Trailers 10, 12, 14, and 17 was exposed to local precursor emissions for about one to three hours. Furthermore, the air arriving at Trailers 16 and 19 during the afternoon is shown to have come from heavy precursor emission areas (Baton Rouge area) downwind. Since the ozone levels were slightly higher (10 to 20 ppb) at Trailers 16 and 19 than at Trailers 10 and 17 upwind, it is quite possible that the upwind precursor emission sources (in the Baton Rouge area) contributed to the slightly higher ozone downwind. Finally, the conspicuously lower ozone levels at Trailer 12 compared to Trailers 10 and 17, despite similar time exposure to local precursor sources, again suggests that the local emissions near Trailer 12 restrict any ozone build-up, at least at close range.

The surface trajectories for Trailer 13, which reported the highest ozone measurement of the day (113 ppb), do not show the air to have passed over any significant precursor emissions area. However, the FSL trajectory (Appendix D) indicates that some of the air arriving at Trailer 13 in the afternoon may have passed over New Orleans during the morning around 4 a.m. to 8 a.m. CDT. Some of the more buoyant emissions in the New Orleans area could have been mixed into the layer of air (above the early morning inversion) which eventually arrived at Trailer 13.

All three of the FSL trajectories for the 16th show that at least some of the air arriving in Louisiana that day had passed near Jackson, Mississippi, two days earlier and near Atlanta, Georgia, three days earlier. The long-range sources could possibly account for an elevated background concentration of ozone. However, with such a long travel time, and exposure to two or three periods of daytime mixing, it is not likely that these sources would cause isolated high ozone measurements.

The generally low ozone values on September 16th, compared to the much higher overall readings on August 25th and 26th, appear to be mainly the result of the much higher ventilation present on September 16th, rather than any difference in the transport processes. The peak ventilation on September 16th was about twice what it was on August 25th-26th, and correspondingly, the ozone levels on September 16th were only about half of what they were on August 25th-26th, despite similarities of abundant sunshine and light wind speeds.

4.0 CASE III - SEPTEMBER 8-9, 1976

The main weather feature on September 8th was a weak low pressure system centered over southeastern Louisiana (see Appendix A). This low pressure system moved northeastward out of the state by the 9th, and was replaced by a weak ridge of high pressure ahead of an advancing cold front. Scattered afternoon thundershowers occurred in the Lake Charles area, and a few isolated thundershowers were spotted late in the afternoon in extreme southeastern Louisiana - from the New Orleans area to the south and east - on the 8th (see Appendix B). Elsewhere in southern Louisiana on the 8th, partly cloudy skies prevailed. On the 9th, partly cloudy skies covered all of southern Louisiana until about 4 p.m. CDT when numerous thundershowers built rapidly in southwestern Louisiana, and few scattered thundershowers occurred in the New Orleans area. Most of the thundershowers had dissipated by 9 p.m. CDT on the 9th. On the 8th, the peak mixing height varied from about 1,300 to 1,500 meters while the afternoon transport wind was about 2.5 meters per second, giving a ventilation from about 3,000 to 4,000 m^2/sec across the inland portions of southern Louisiana. On the 9th, the peak mixing height ranged from about 1,100 meters at Trailer 13 to about 1,500 to 1,600 meters in the New Orleans, Baton Rouge, and Lafayette areas, to about 1,700 meters in the Lake Charles area. The afternoon transport wind on the 9th was near 3.0 meters per second over most of southern Louisiana, but increased to about 5.0 meters per second in the Baton Rouge area, giving a range in ventilation from about 3,000 m^2/sec around Trailer 13 up to about 8,000 m^2/sec in the Baton Rouge area.

Ozone Distribution

The ozone distribution on the 8th was characterized by widespread levels of high ozone around 80 to 120 ppb, with an isolated area of very high ozone (greater than 120 ppb for six hours and measured up to 184 ppb) around Trailer 08, and an isolated area of low ozone (maximum of 56 ppb) around Trailer 12 (see Appendix B). Low ozone also occurred at Trailer 10 (maximum 69 ppb). The ozone concentration first exceeded 80 ppb by 10 a.m. CDT on the 8th at Trailers 13 and 14 and last fell below 80 ppb after 9 p.m. CDT at Trailer 14.

High ozone was widespread again on the 9th, with all sites reporting over 80 ppb. Again, Trailer 12 was conspicuously low, frequently by about half, compared to the nearest surrounding trailers. Very high ozone (greater than 120 ppb) was reported for three to five hours duration at all of the sites in the state to the southeast of Baton Rouge, except Trailer 12, with a maximum reading of 164 ppb at Trailer 13 for the hour ending at 4 p.m. CDT. The ozone concentration was first reported over 80 ppb for the hour ending at 10 a.m. CDT and last reported over 80 ppb for the hour ending at midnight.

Ozone Transport

Surface trajectories for the 8th show that the air arriving at Trailer 08 at the time of its high reading of 184 ppb had lingered over the Baton Rouge area for several hours prior. In contrast the air arriving at Trailer 10 on the opposite side of Baton Rouge had come from rural areas and showed low ozone - about 100 ppb lower than at Trailer 08. This data strongly suggests that most of the 100 ppb difference between the two sites was caused by precursor emissions in the Baton Rouge area. The surface trajectory for Trailer 17 appears to show a lingering of the air over a heavy precursor emissions area to the north, but most of the emissions in that area occur along and close to the Mississippi River, with only undeveloped rural land to the north. Thus, the lower ozone level at Trailer 17 compared to Trailer 08 is not so surprising. The surface trajectory for Trailer 13 on the 8th shows that the air arriving in the afternoon had come from New Orleans earlier in the morning. However, the ozone level at Trailer 13 was about the same as the ozone level at Trailer 14 upwind. Precursor emissions from New Orleans may have helped to raise the ozone levels at both of these sites, especially since much lower readings were reported at Trailer 12. Again, it appears that either there are no precursor sources to the north of Trailer 12 that effect the ozone level at that site (in which case with a north wind the site would show the general background level), or possibly a nearby emission source to the north or northeast emits an ozone scavenger which lowers the ozone at that site.

A surface trajectory suggests that the high ozone that lasted above 80 ppb until 9 p.m. at Trailer 14 on the 8th may possibly have been formed from precursors emitted in the Gulfport, Mississippi area during the early morning hours. Also, the FSL trajectory for Trailer 08 shows that emissions from the Gulfport area on the 7th could have affected the air arriving at Trailer 08 on the 8th, but the occurrence of numerous showers in the Gulfport area on the 7th makes this possibility seem doubtful.

Surface trajectory analysis for the 9th supports the past evidence that precursor emissions in the Baton Rouge area and along the Mississippi River to the south, strongly contribute to high ozone measured at sites downwind. A comparison of the trajectories for Trailers 08 and 17 for the time ending at 11 a.m., 1 p.m., 3 p.m., and 4 p.m., shows that the highest ozone reading occurs when the trajectory is pointing toward Baton Rouge. As on the previous day, the ozone level was considerably lower upwind from Baton Rouge at Trailer 10 - by as much as about 70 ppb.

The surface trajectory for the time of the highest reading at Trailer 13 (164 ppb - also the highest in the state) for the day shows that the air had come from the New Orleans area that morning. Also, the surface trajectory for the high ozone at Trailer 13 at 11 p.m. CDT hints that this air mass may have originated in the New Orleans area from the previous night or afternoon of the 8th.

The FSL trajectories for the 9th suggest that no important long-range transport took place. Background levels of ozone may have been increased slightly in the air arriving in the central part of southern Louisiana, since the trajectory from that area remains over land for 72 hours, and does come from moderate precursor emissions areas in southern Alabama and Georgia. However, since the air over southeastern Louisiana apparrently came from the Gulf of Mexico, it is more likely that the high ozone reported on the 9th is largely from sources within Louisiana.

The surface trajectories for both of the high ozone measurements after sunset on the 8th and 9th hint that the air had crossed moderate to heavy precursor emission areas within the previous 24-hours, and show that the air then moved out over the Gulf of Mexico before returning inland across unpopulated marsh areas. Apparently, whatever the process that is normally reducing the ozone levels to less than 80 ppb by no later than 7 pm in inland areas is occurring much more slowly offshore and along the immediate coastline.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The evidence in this report gives strong support to the conclusion that heavy emissions from the Baton Rouge area of precursors to ozone give rise to high levels of ozone downwind. This effect was most prominent in the measurements at Trailers 08 and 10 which are about 10 to 15 miles from Baton Rouge. Lesser, but still quite noticeable increases in the ozone level from emissions in the Baton Rouge area appeared at Trailers 16, 17, and 19, which are about 30 to 45 miles from Baton Rouge, when these sites were downwind.

Similar evidence suggests that high levels of ozone at Trailer 13, about 30 miles from New Orleans, were induced by precursor emissions from that city, when the trailer site was downwind. The effect of New Orleans emissions on the two nearby sites - Trailers 12 and 14 which are about 10 to 20 miles from the city - is inconclusive, because the predominant wind flow in each case study was from a northerly direction, away from the city. However, the ozone level was generally lower at Trailer 12, west of New Orleans, than at Trailer 14 to the east, in each case study. This observation suggests that either local sources within about five miles to the north (northwest to northeast) of Trailer 12 are reducing a high background level of ozone reported at surrounding trailers, or that Trailer 12 is not being affected by local sources, and thus reflects a background level, while the surrounding trailers are getting higher ozone levels as a result of local precursor emissions. Clearly, additional study of ozone data from the New Orleans area is warranted to help resolve this question.

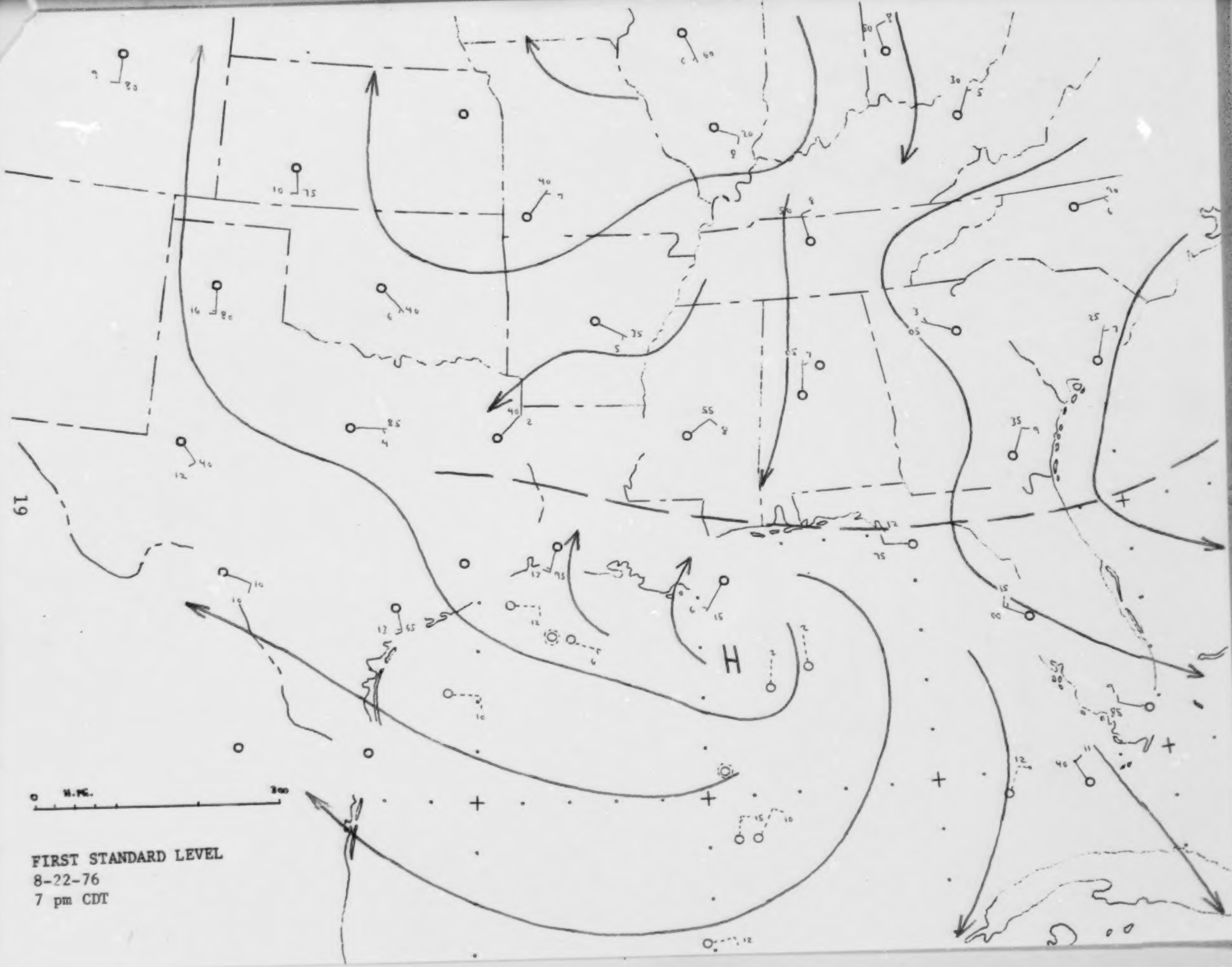
The comparison of ventilation conditions during each of the case study periods gives support to the conclusion that in general, widespread high ozone in southern Louisiana is associated with poor ventilation and that good ventilation conditions result in lower ozone levels.

Also, the two examples of high ozone (over 80 ppb) after sunset indicate that high ozone levels are not depleted as rapidly over the Gulf of Mexico and unpopulated coastal areas compared to the normal decline in ozone after sunset in inland areas of southern Louisiana.

Finally, ozone appears to remain at low levels in areas of extensive shower activity. Increased cloud cover and improved dispersion near large rain areas are probably the main causes of such low ozone.

APPENDIX A

This Appendix consists of the maps used to determine the first standard level (FSL) air trajectories. Winds are plotted for the first standard level at every available upper air site with supplementary surface winds (dashed) where the upper air data is sparse. Each plotted wind vector is pointing to the station site from the direction of the wind flow, with the speed in knots plotted to the right upwind side and the last two digits of the direction in degrees to the left upwind side of the wind vector. Streamlines are analyzed on each map.



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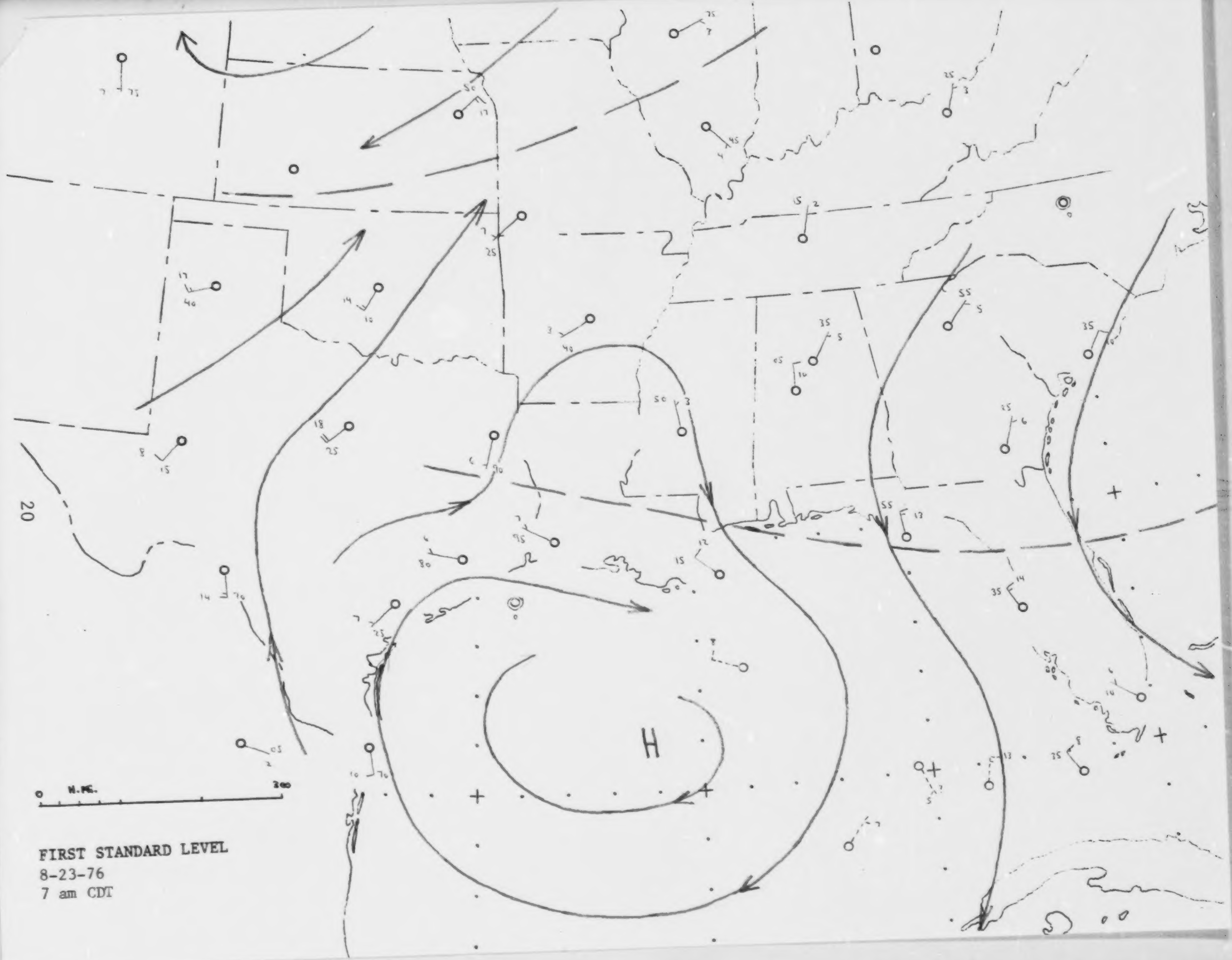

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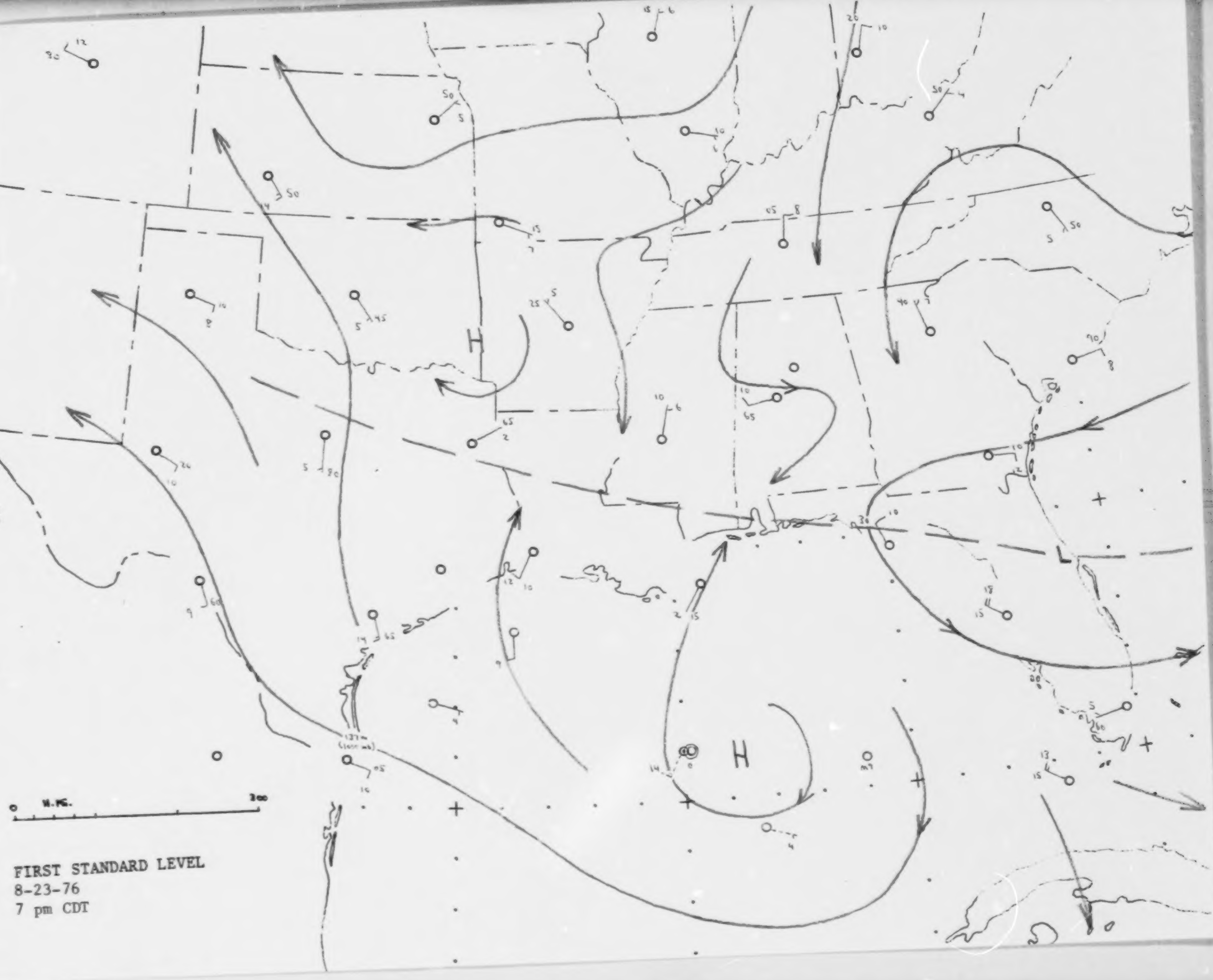
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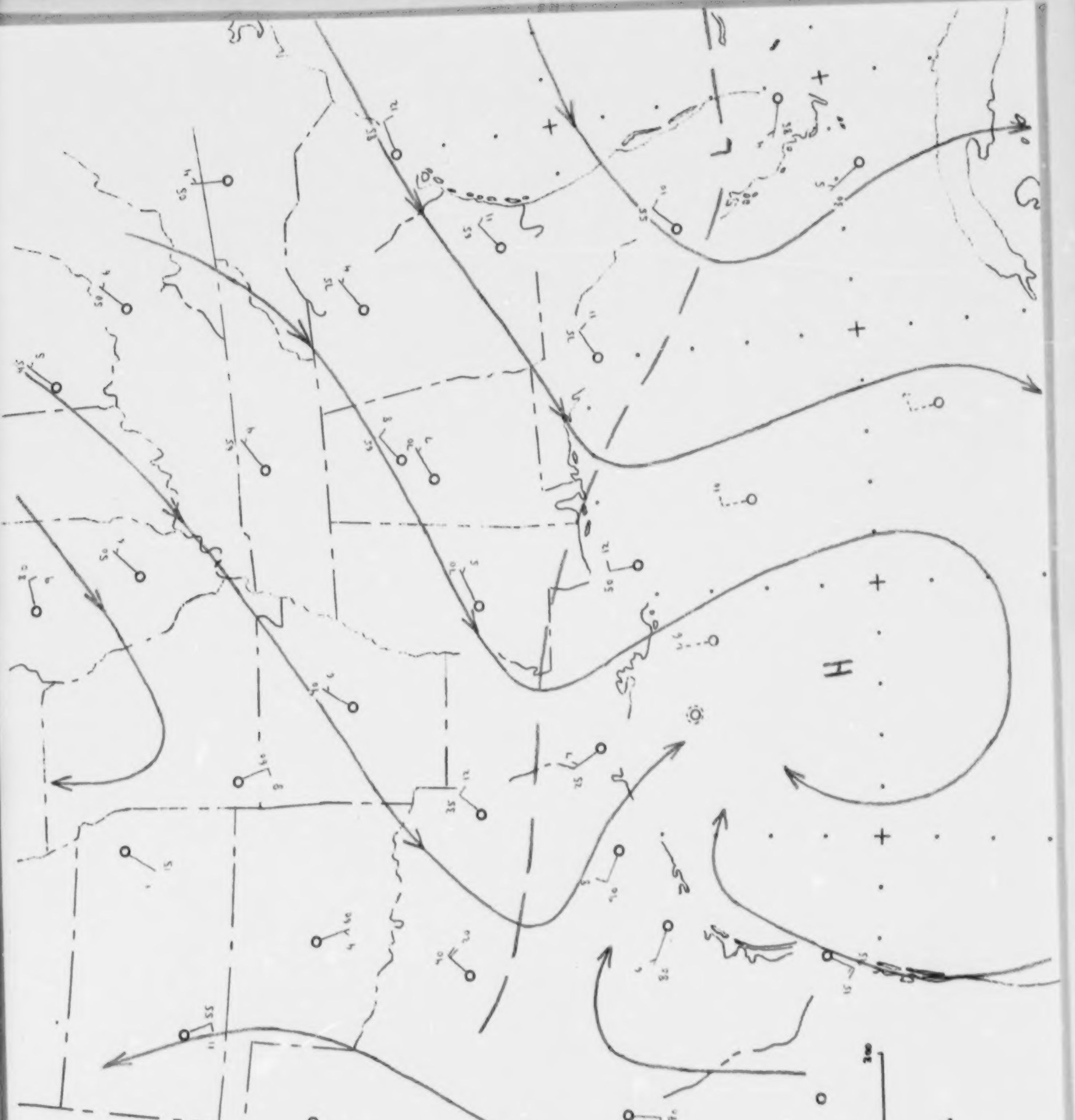

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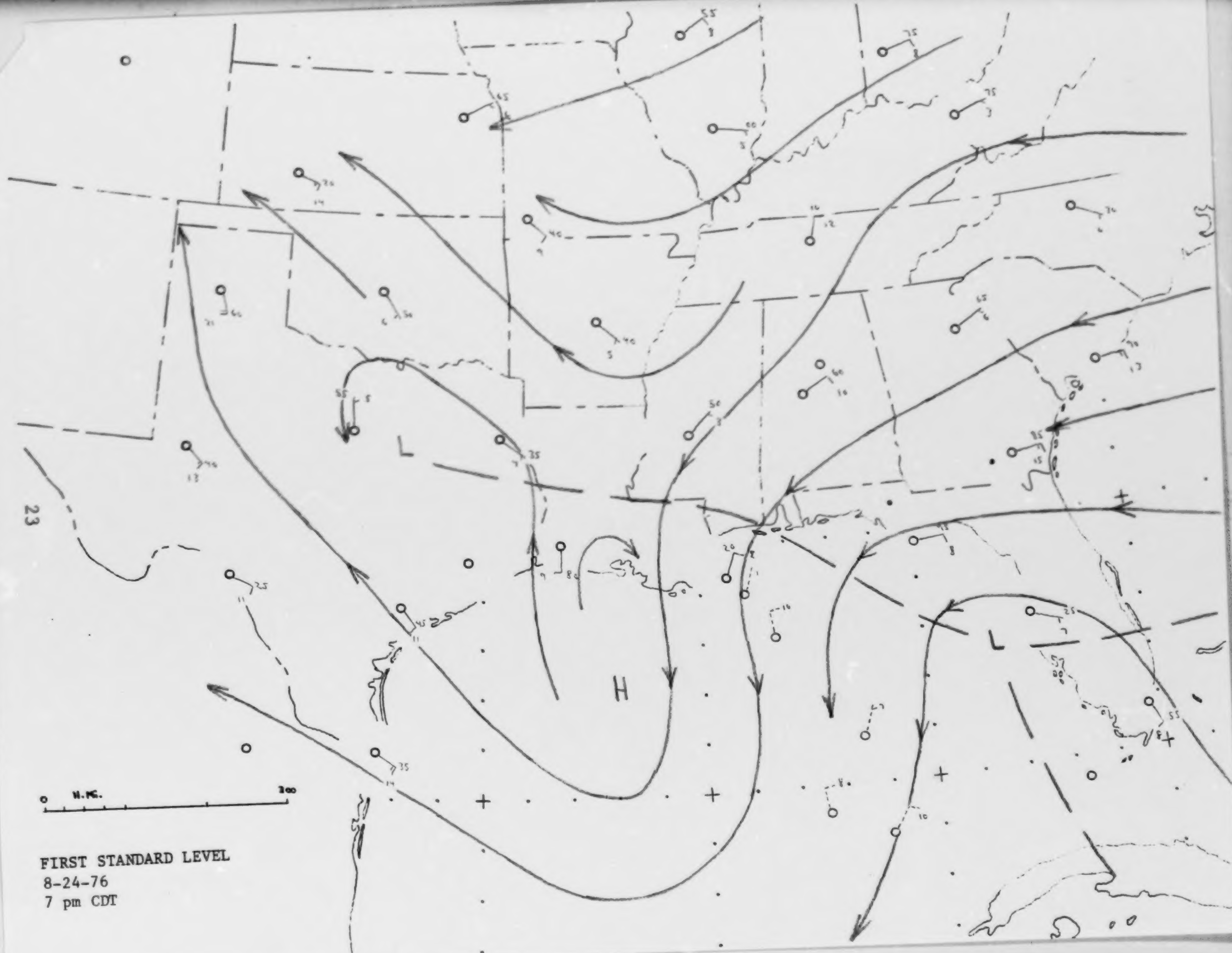
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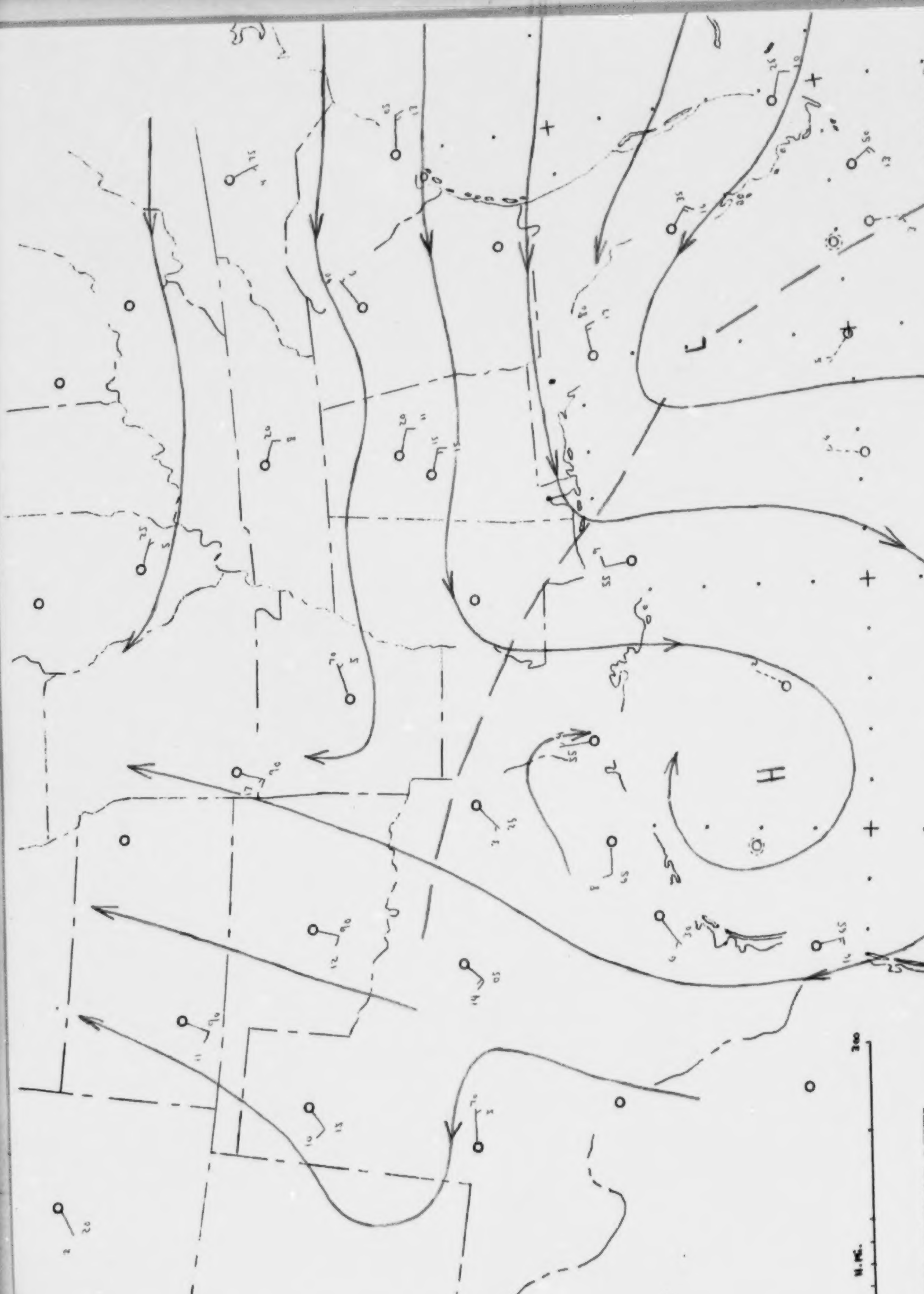

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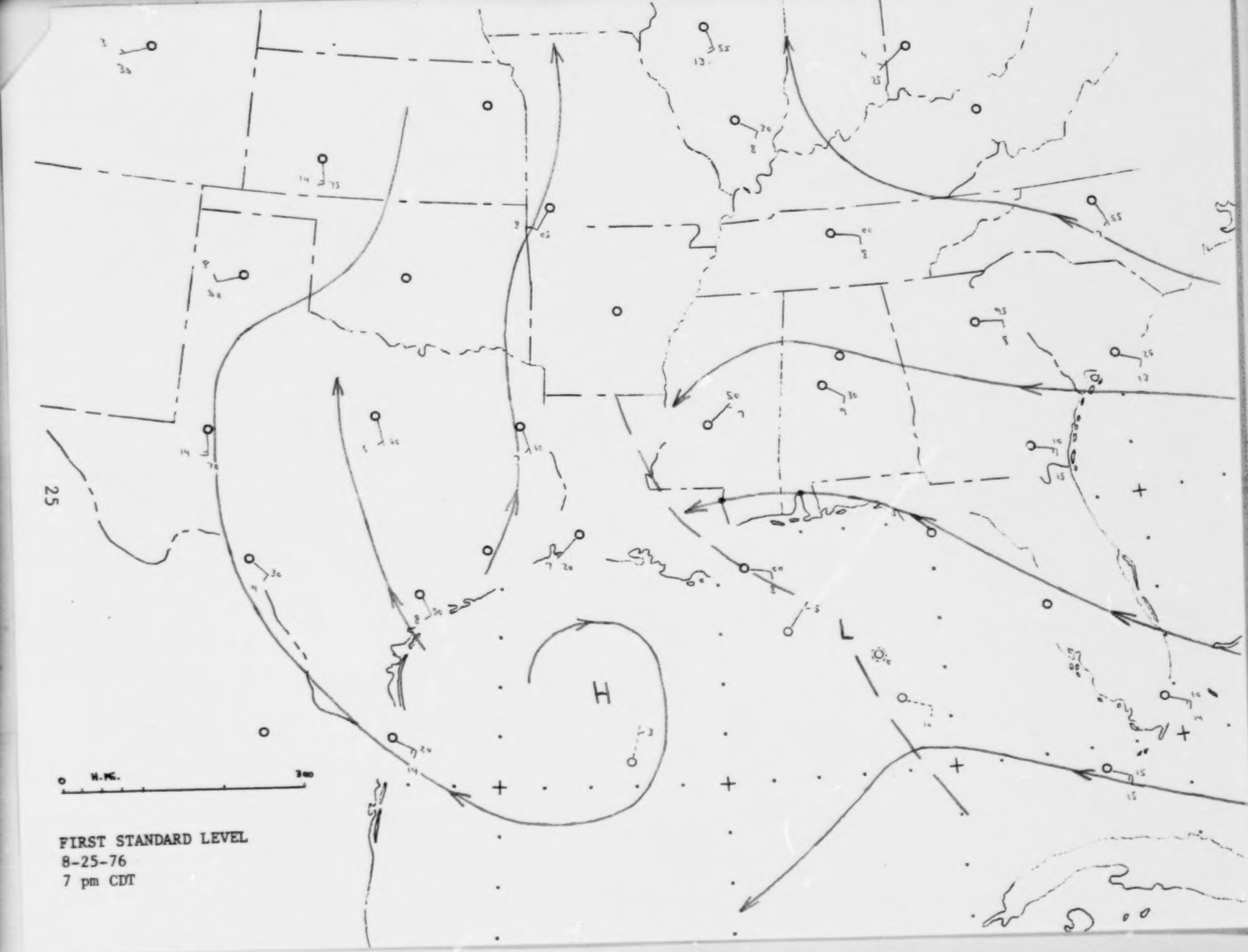

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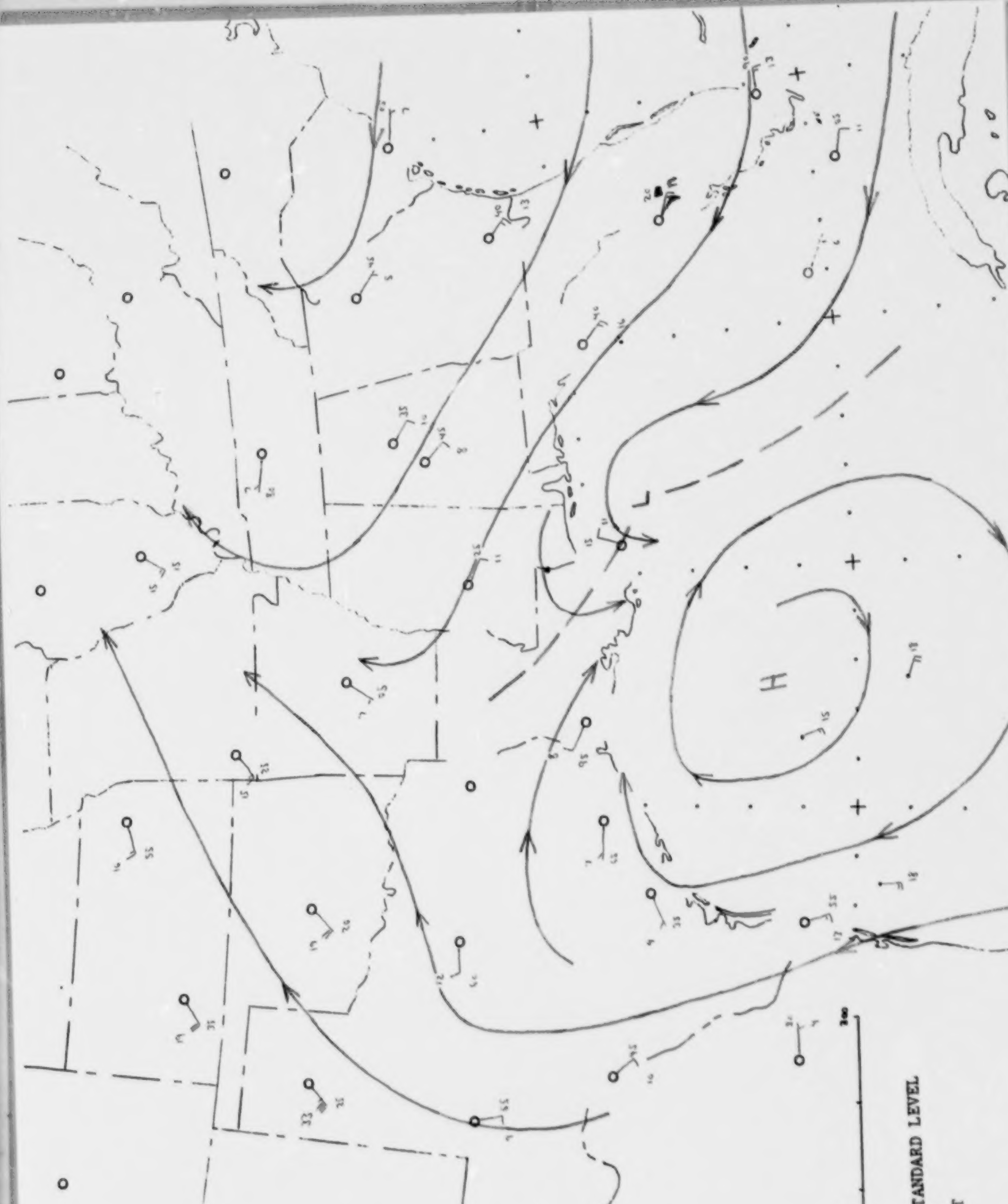

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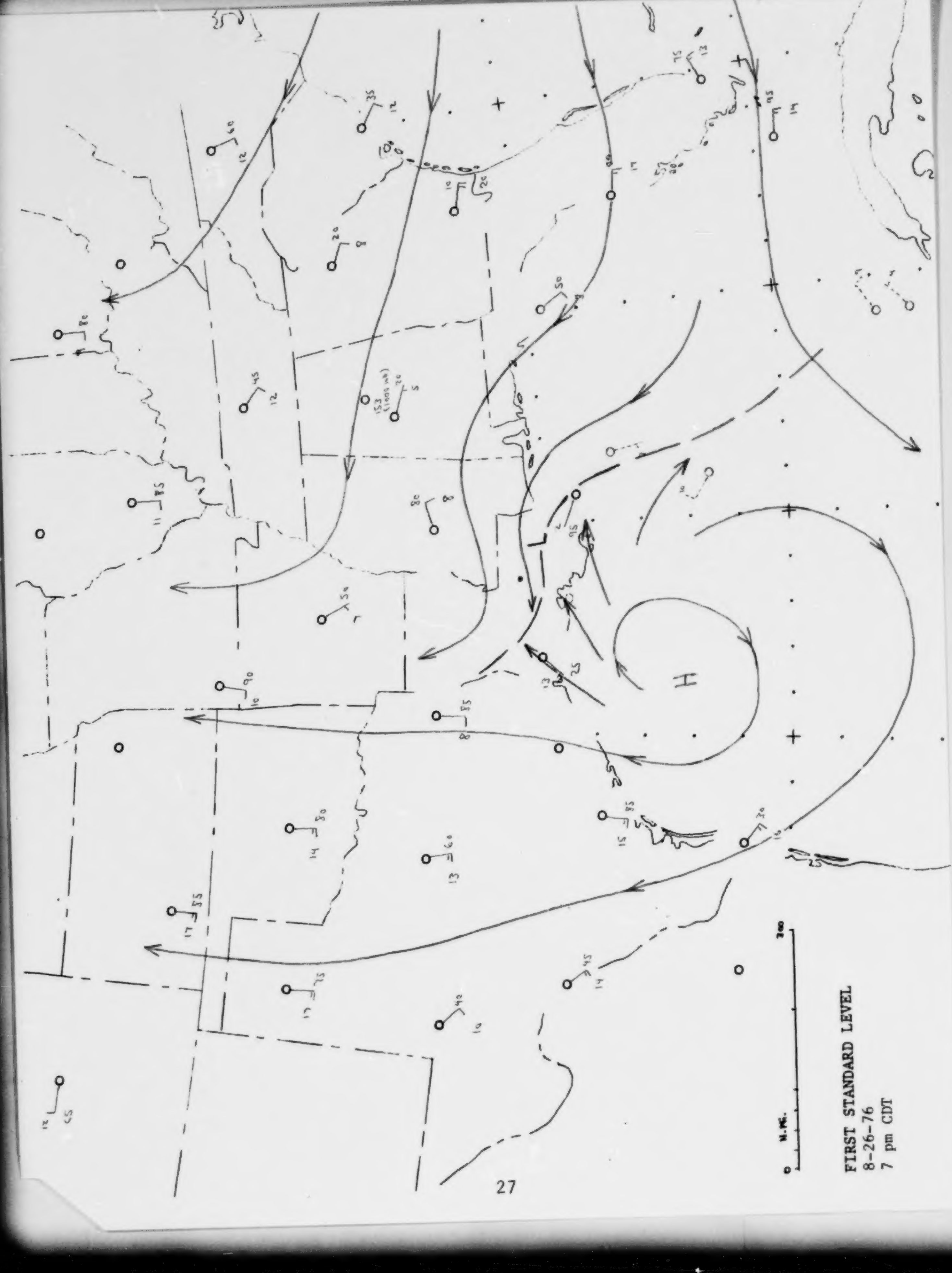
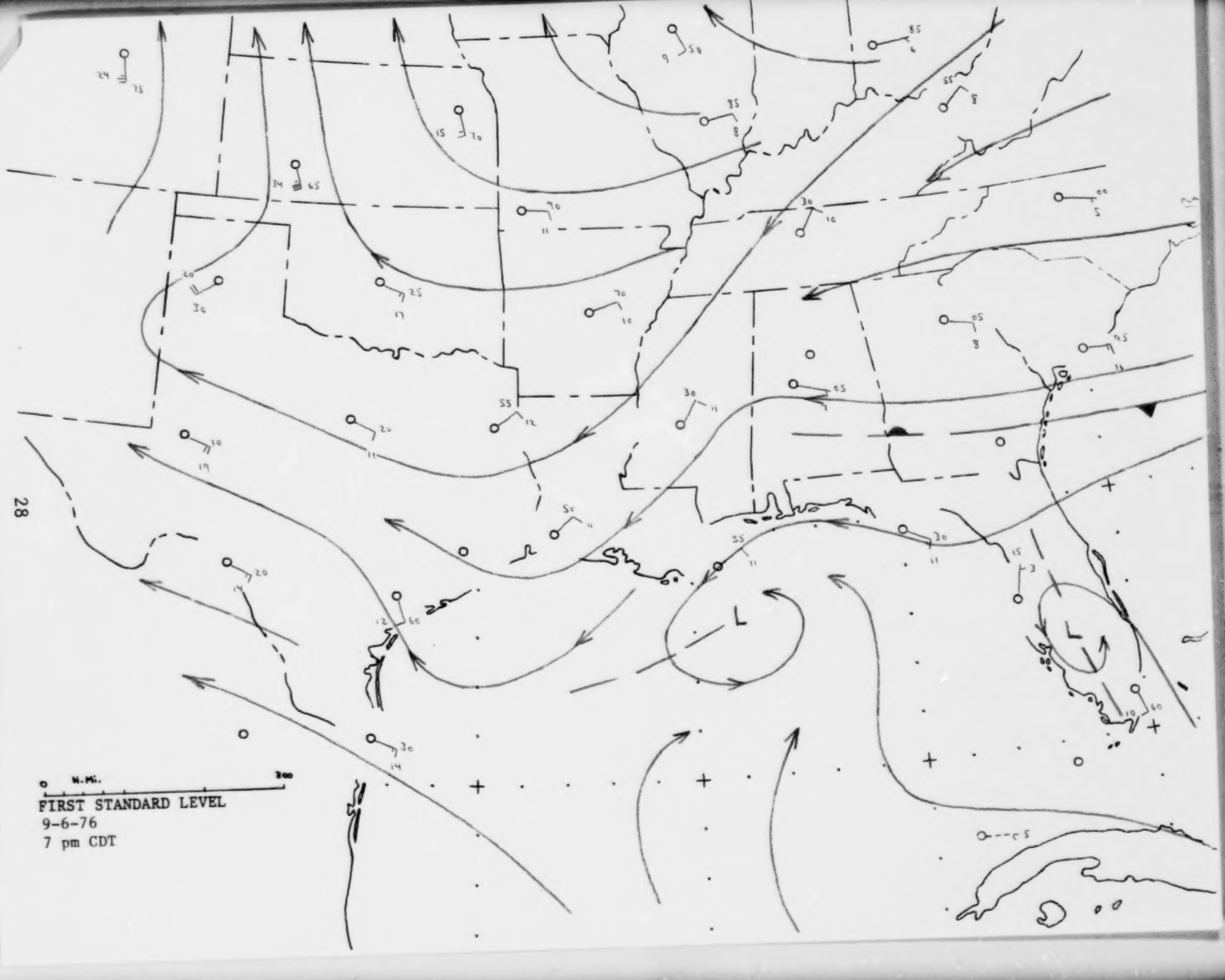


FIRST STANDARD LEVEL
8-26-76
7 pm CDT



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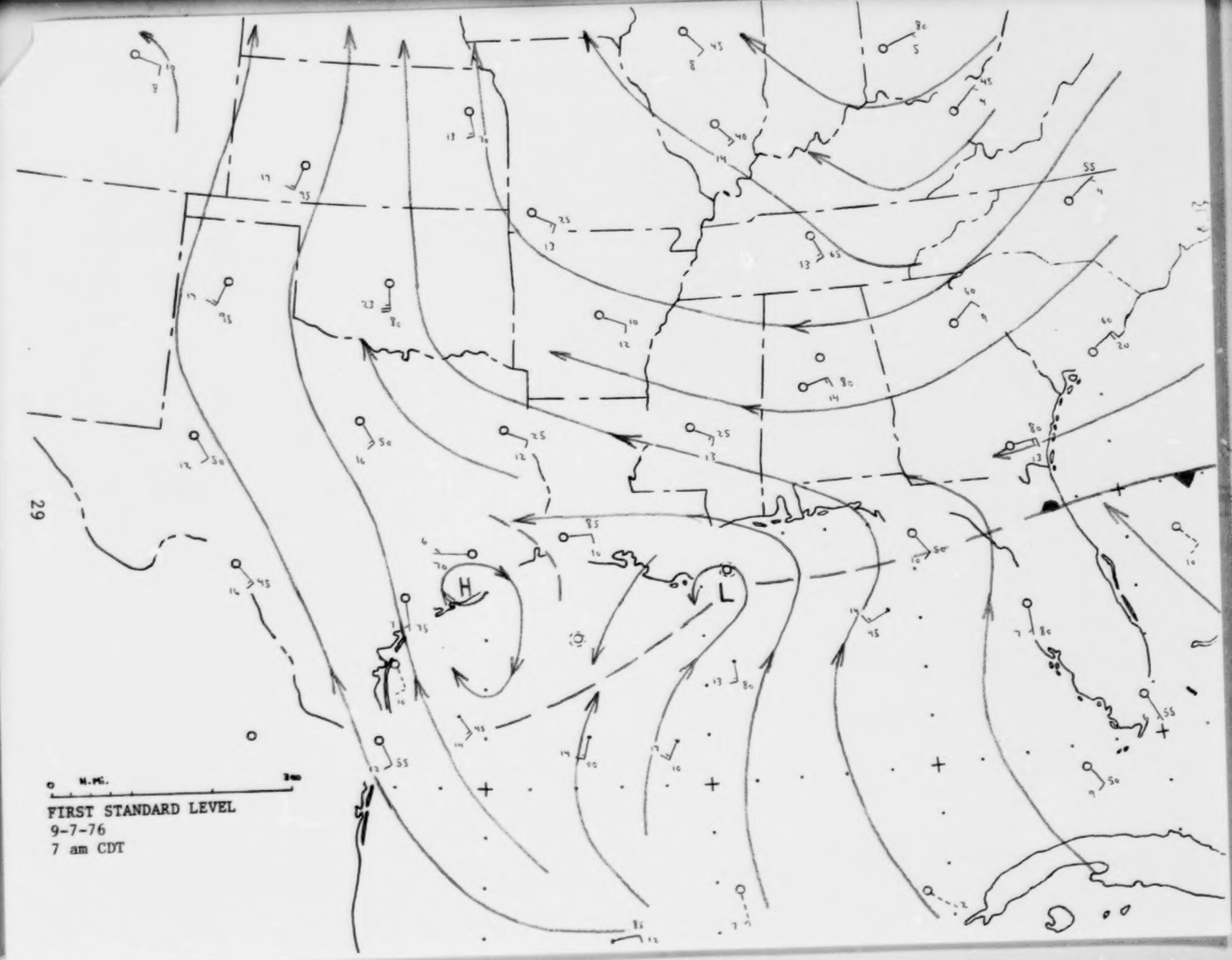

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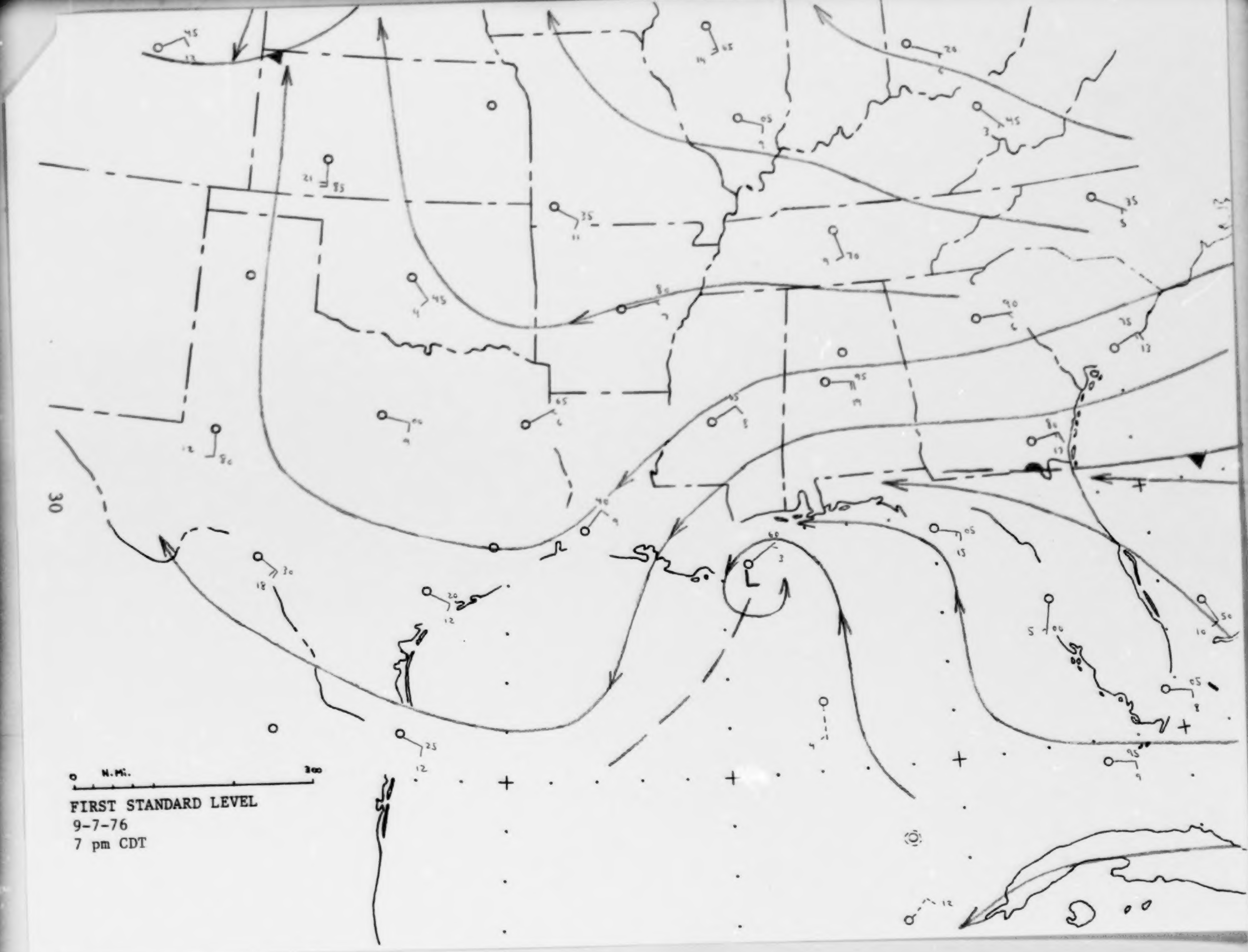
7 am CDT



FIRST STANDARD LEVEL
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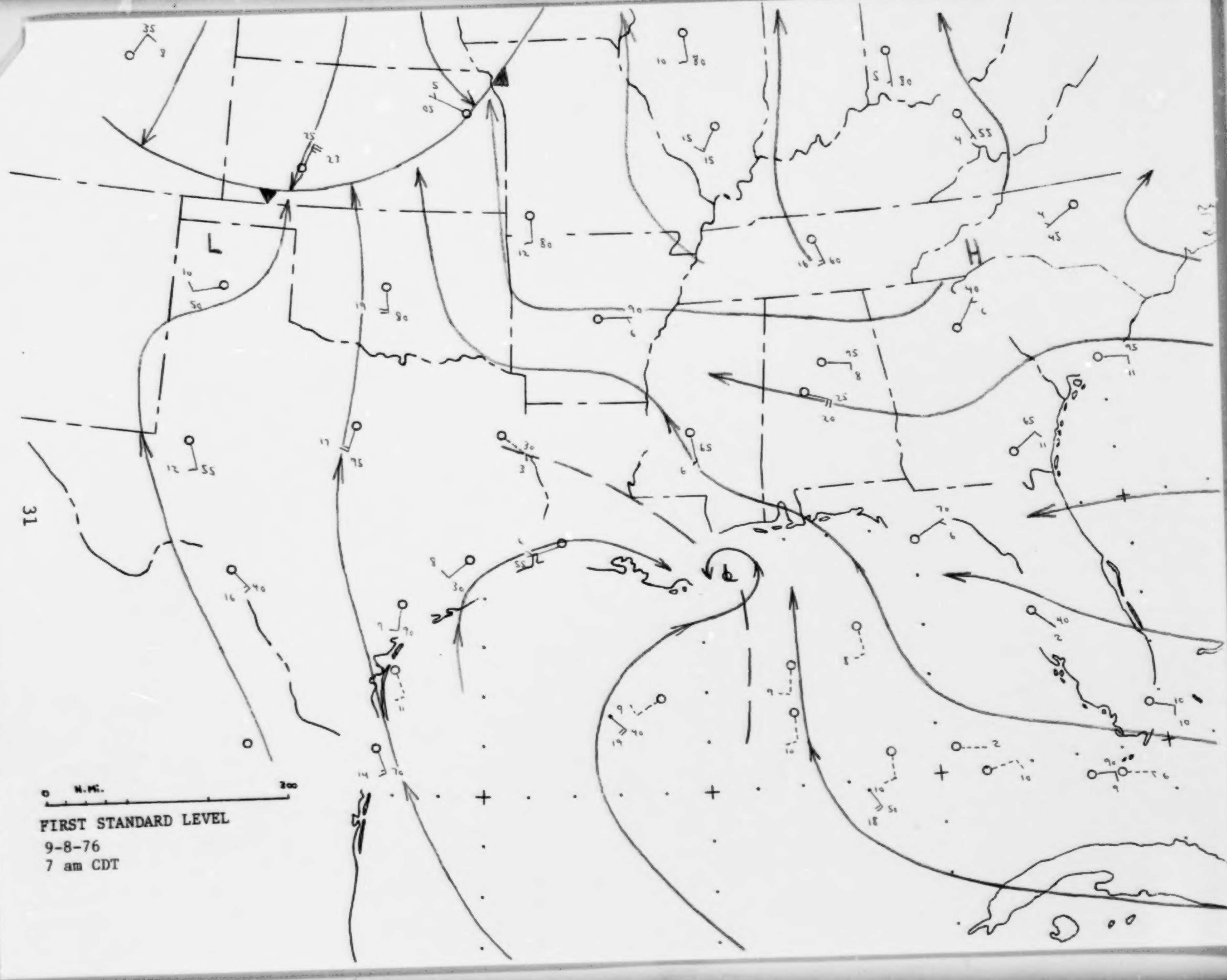
7 pm CDT



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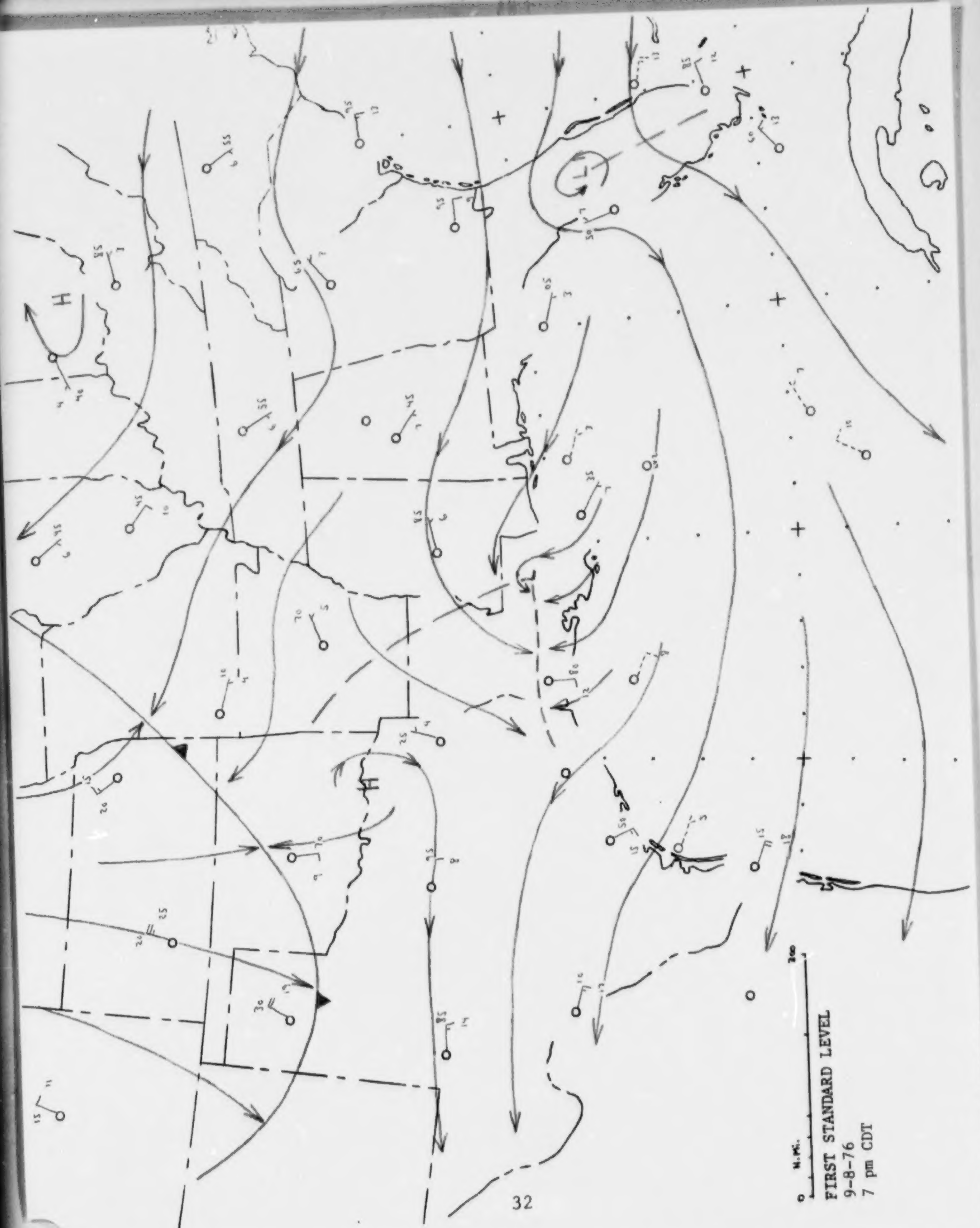
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FIRST STANDARD LEVEL
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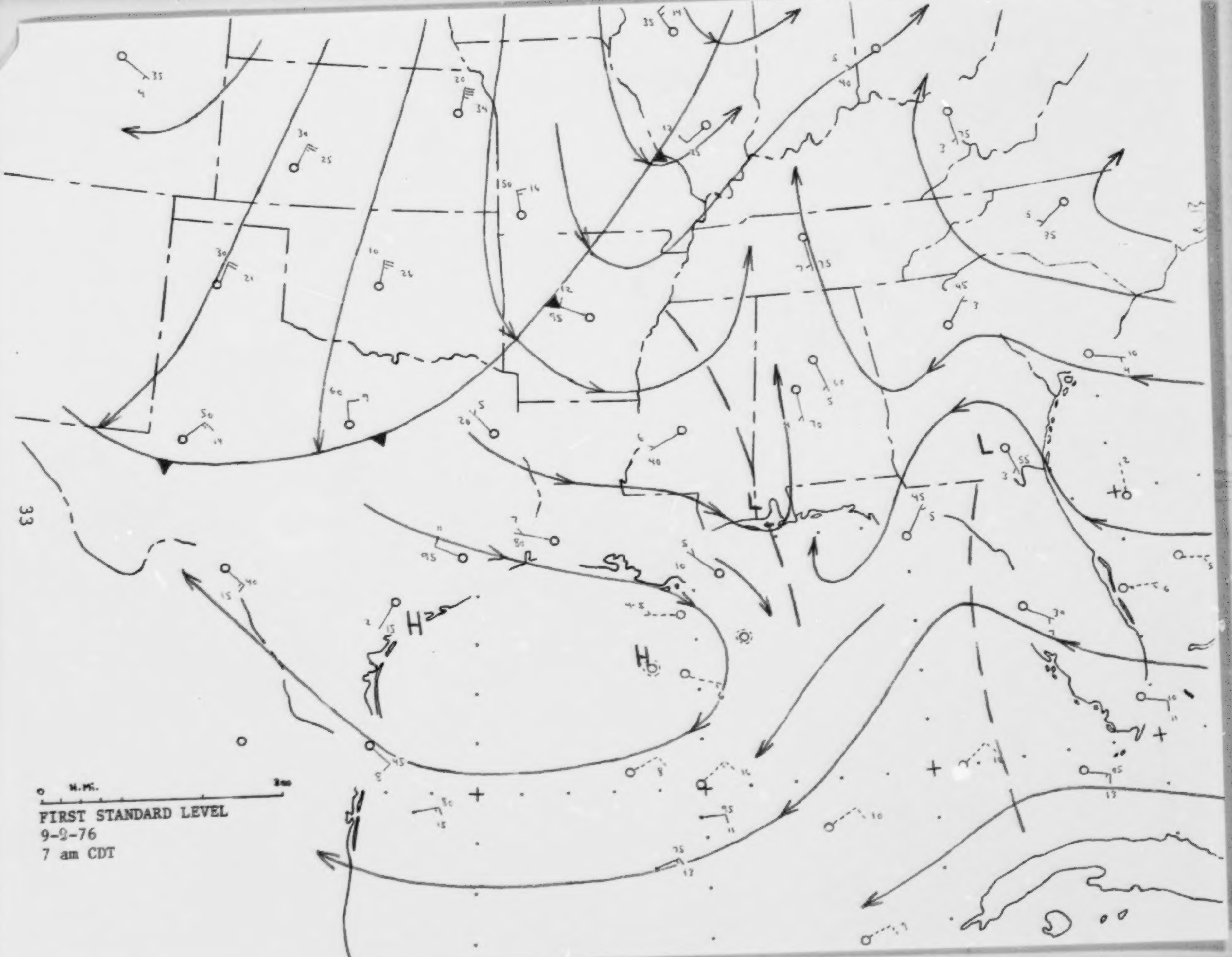
7 pm CDT



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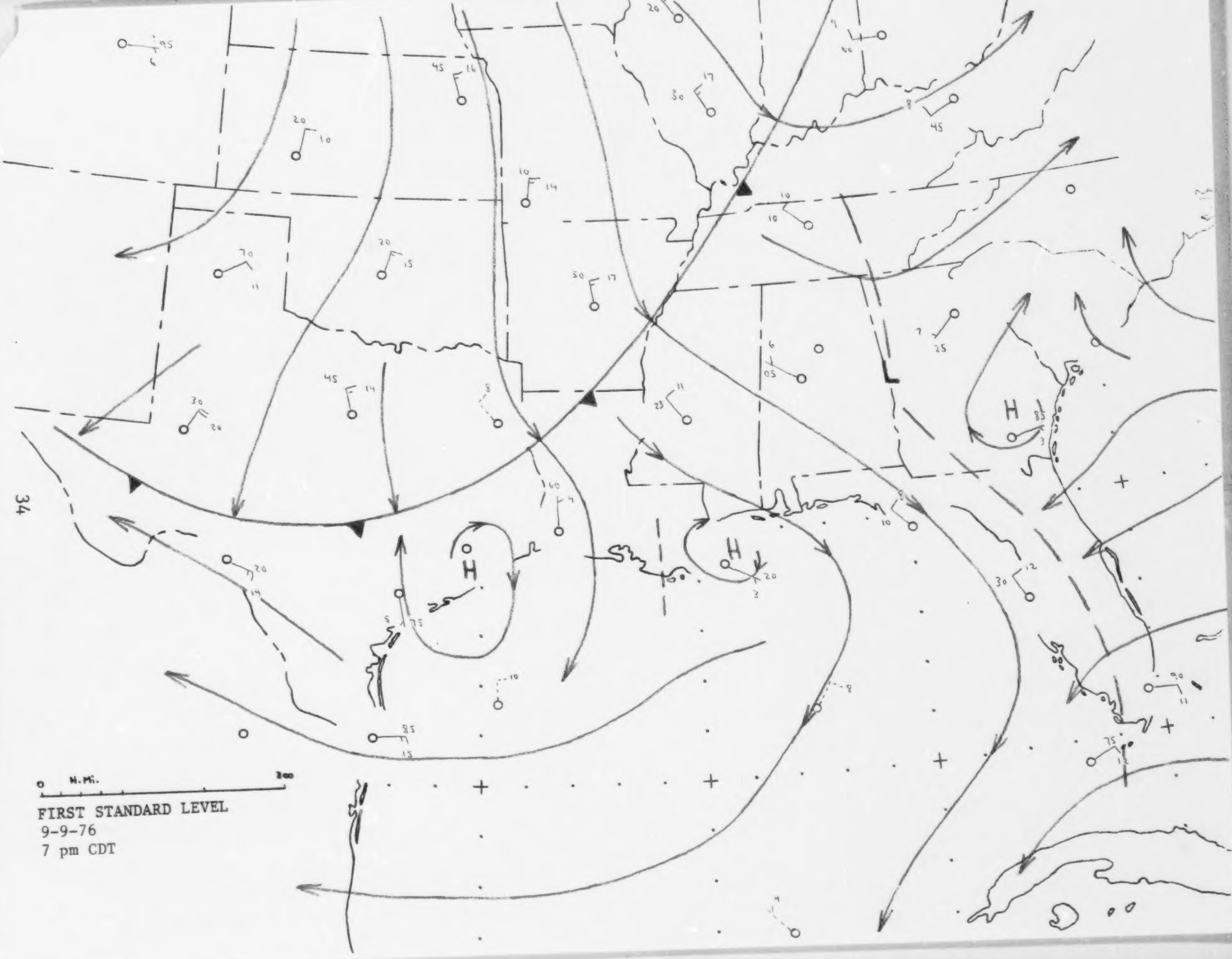
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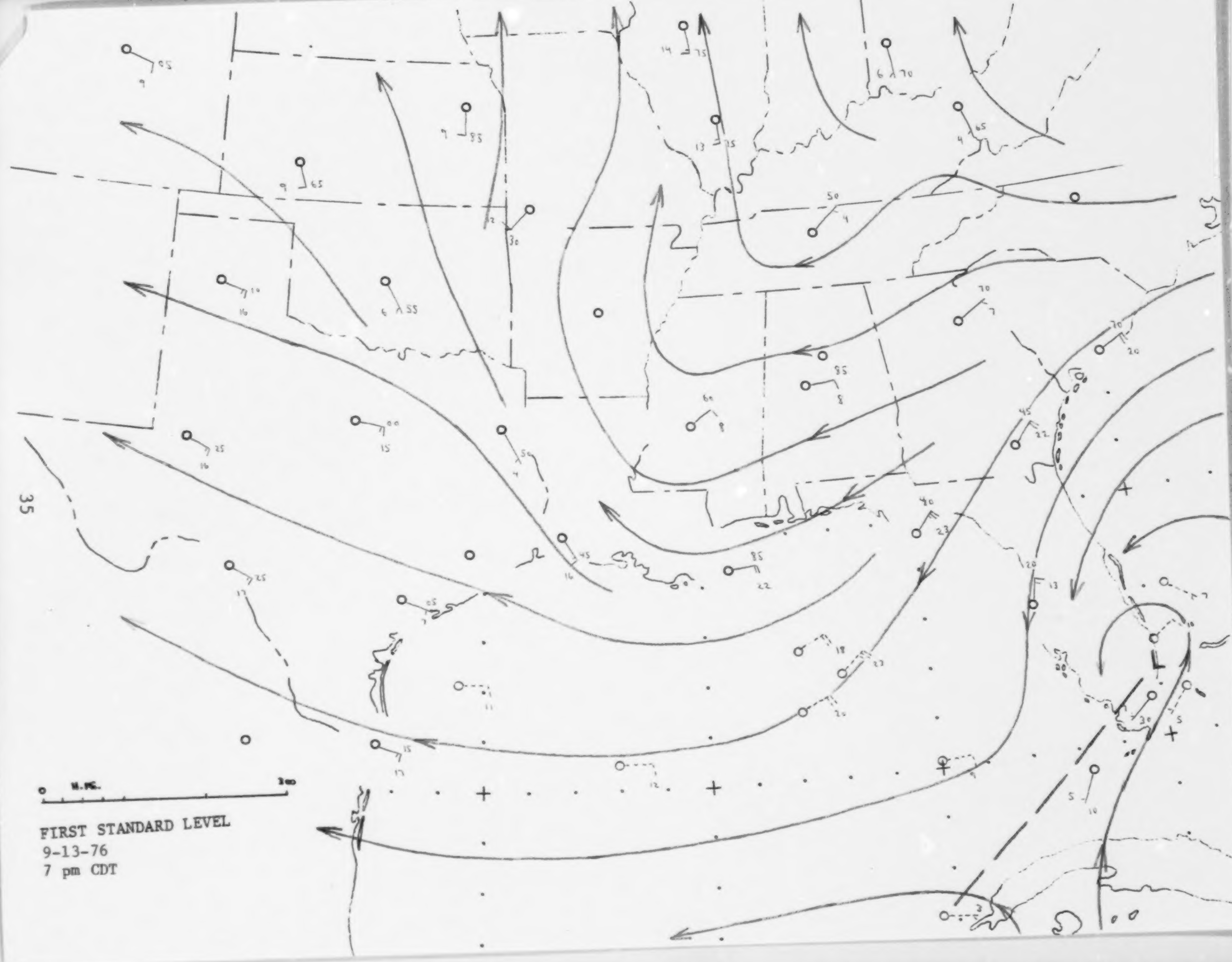

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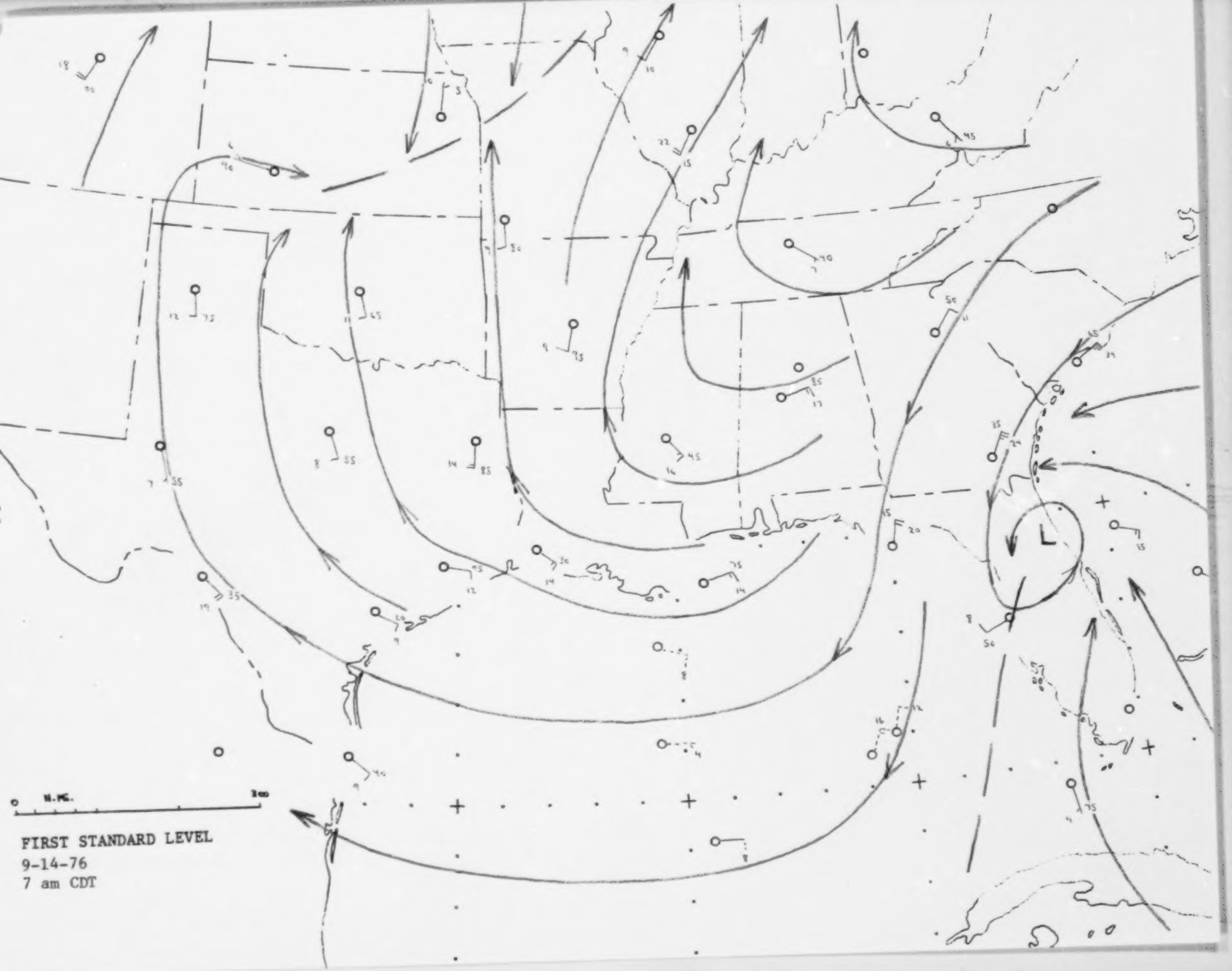

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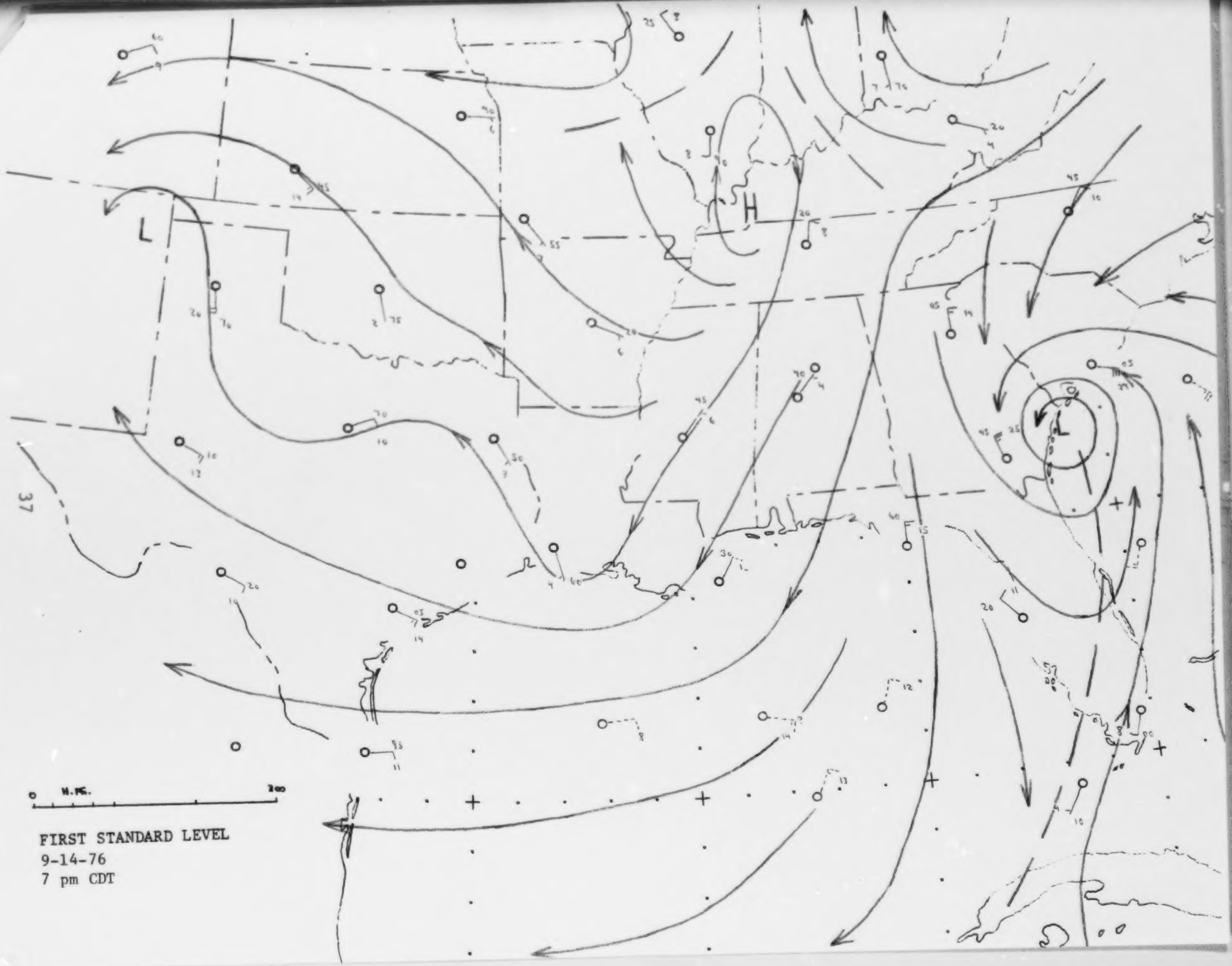
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H
L
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N.MI.
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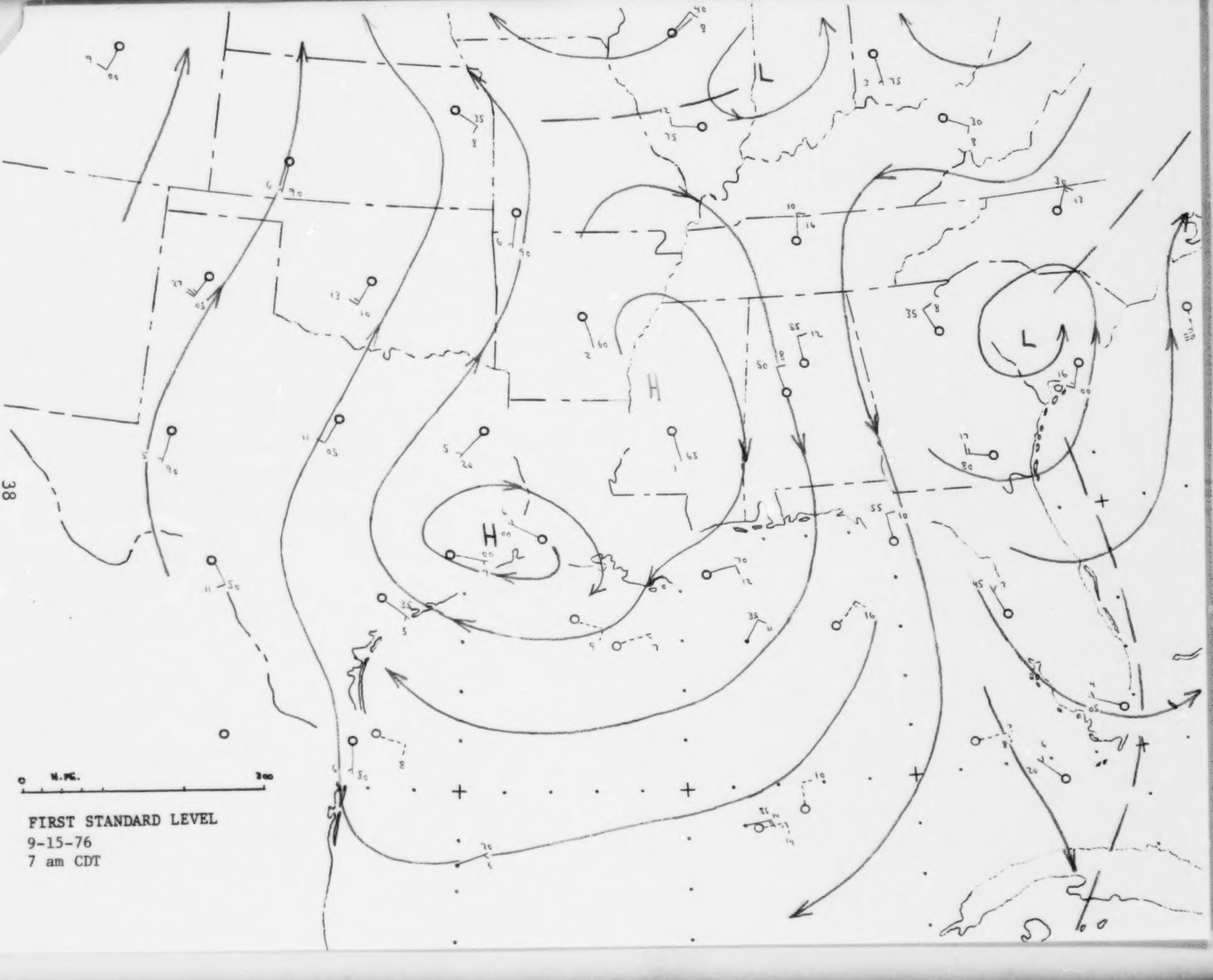
7 pm CDT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H
N.MI.
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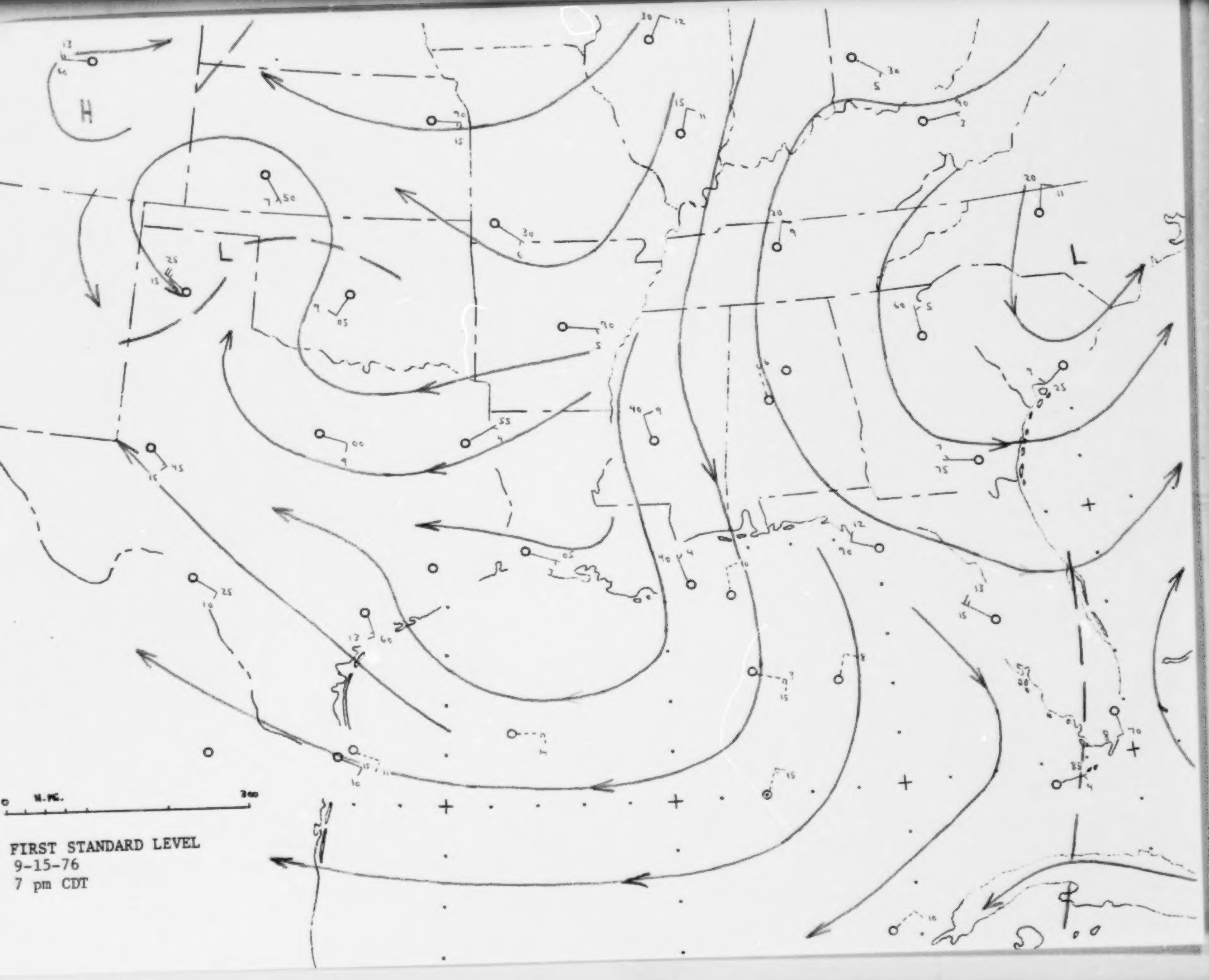
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L
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N.MI.
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FIRST STANDARD LEVEL
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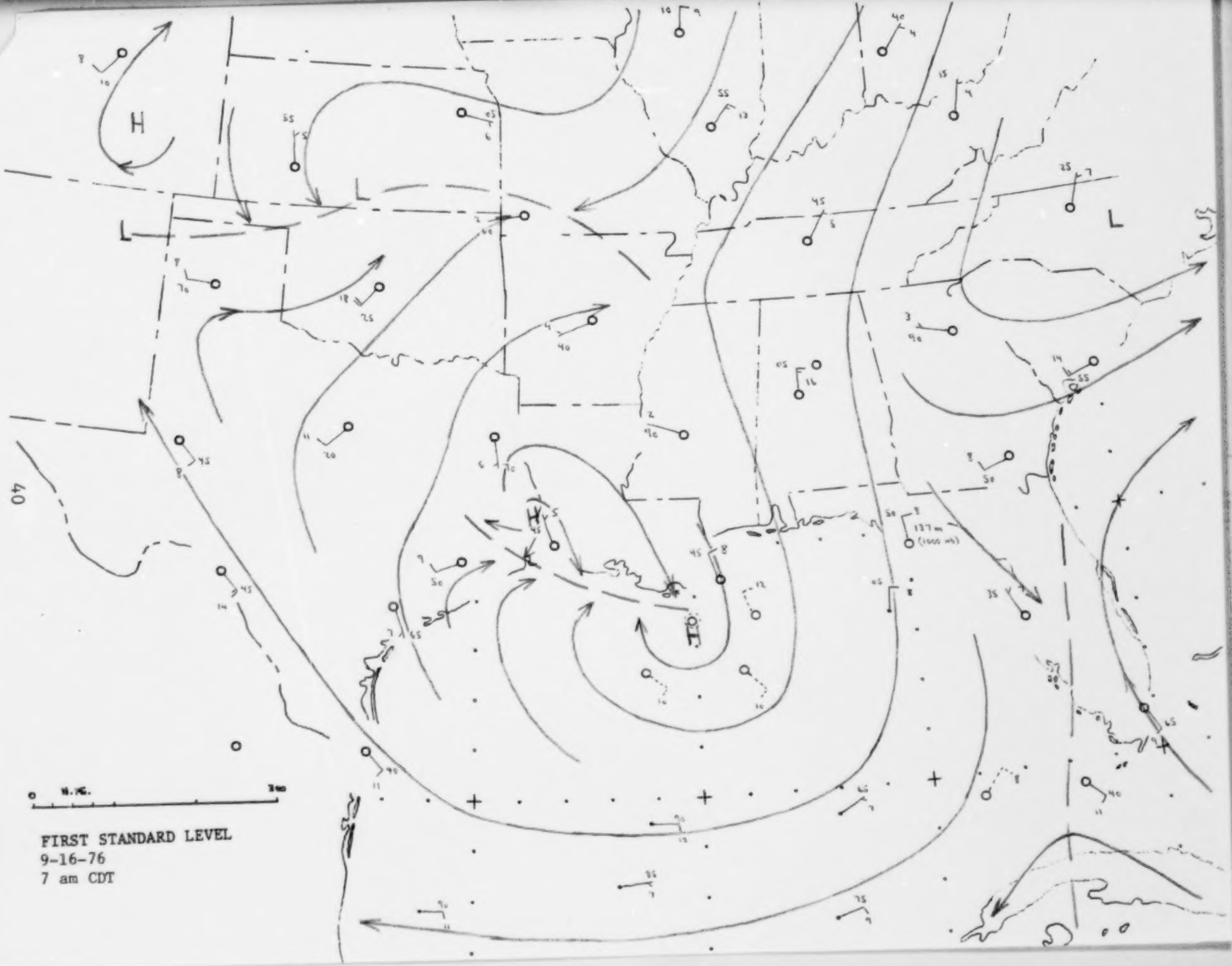
7 pm CDT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L
L
L
H
H
137 m
(1000 mb)
0
N.MI.
300

FIRST STANDARD LEVEL
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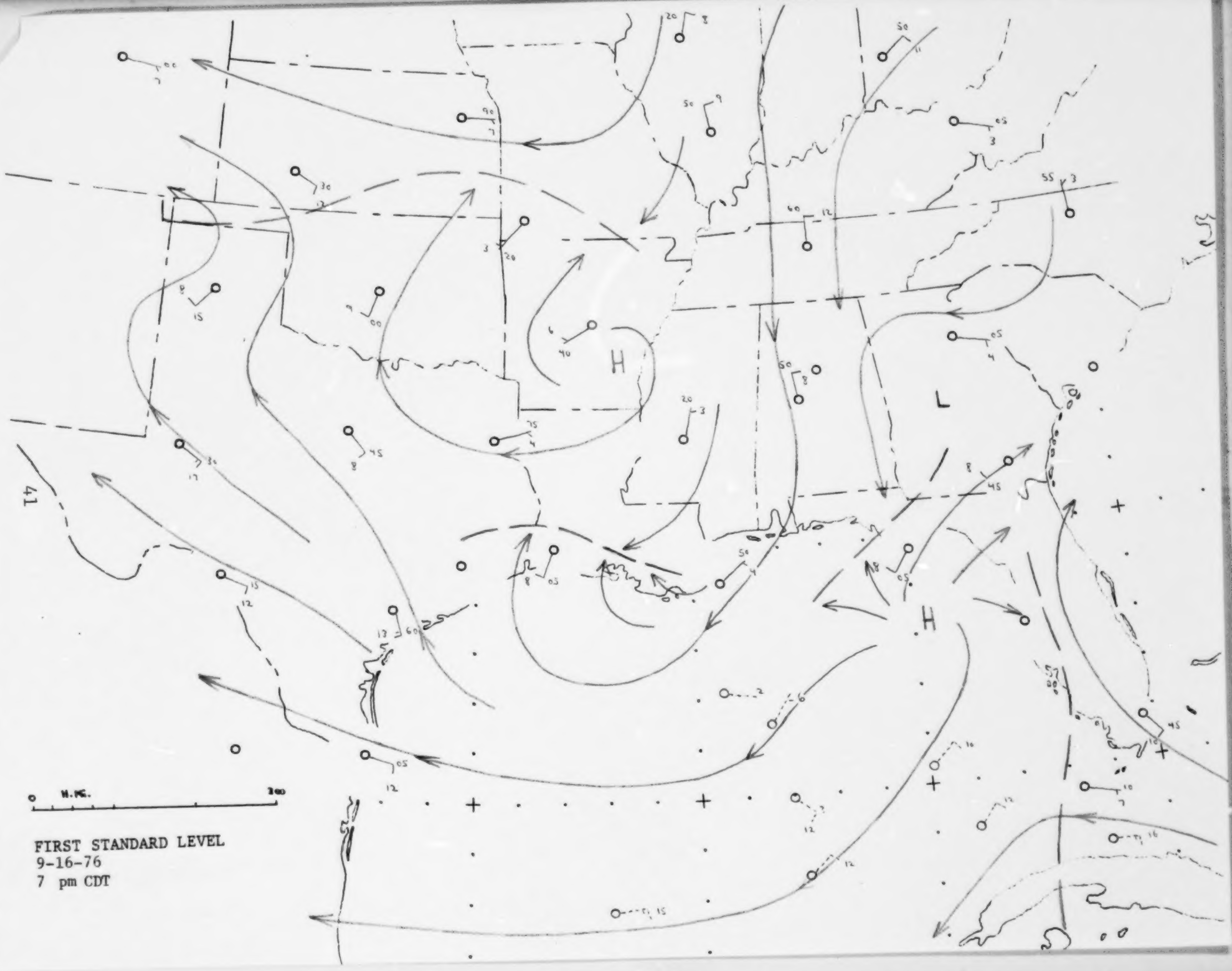
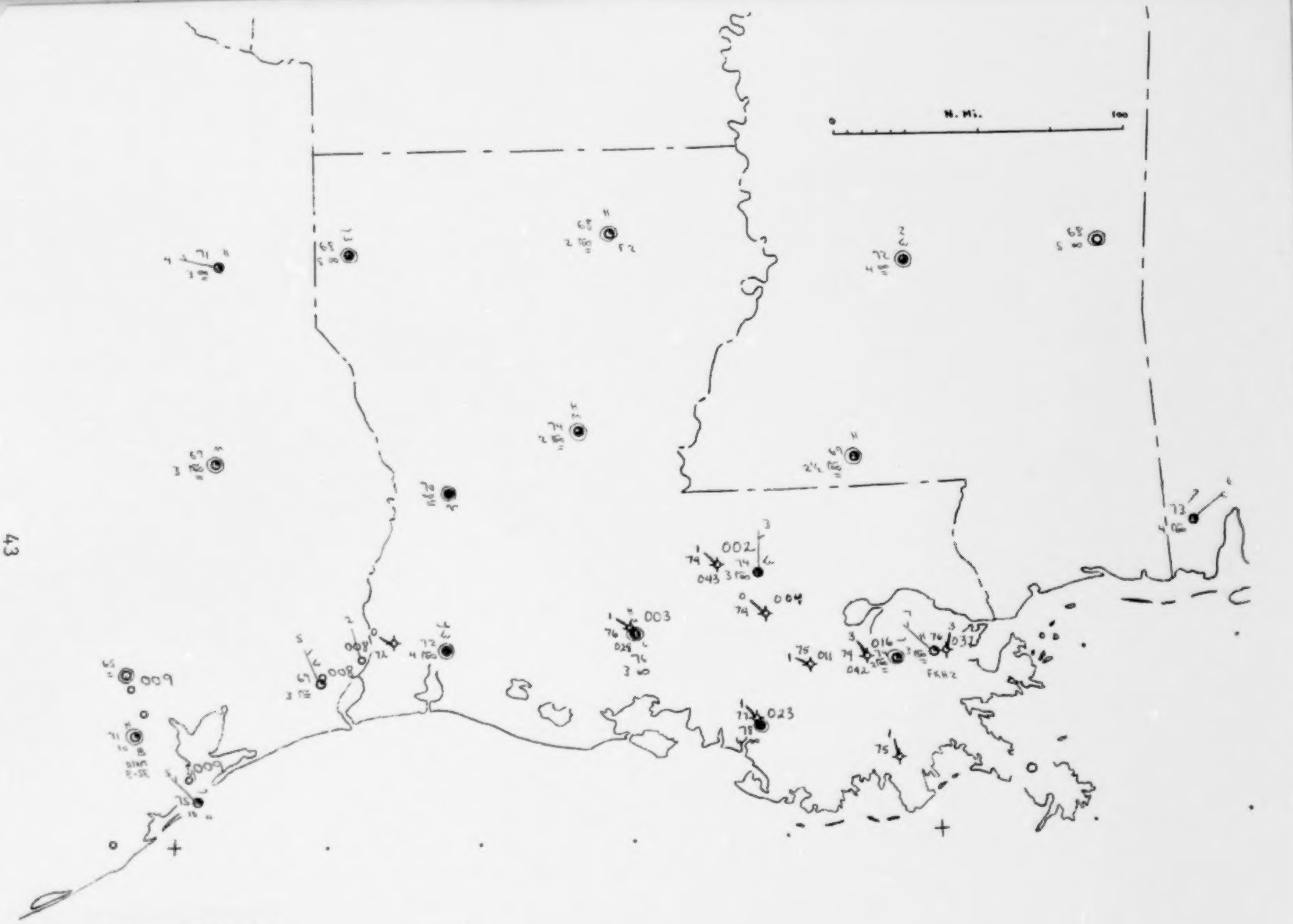
7 am CDT


H
L
H
0
N.MI.
200

FIRST STANDARD LEVEL
9-16-76
7 pm CDT

APPENDIX B

Surface weather and ozone are plotted on the following maps. Large circles denote weather stations, and the smaller circles denote trailer monitoring sites. All of the data plotted at the trailer sites is in hourly averages for the hour beginning at the map time, whereas all other data is instantaneous data recorded 5 to 10 minutes before the map time. Wind vectors are plotted where available as in Appendix A except the numeric direction is not plotted, and the speed plotted for the trailer sites in miles per hour rather than knots as at the weather stations. Ozone is plotted to the upper right of the trailer circle (where space permits) in parts per billion (ppb), and pyranometer data is plotted to the lower left, in langleys. Temperature in Fahrenheit is plotted to the upper left at all sites, with present weather (symbol form) and visibility in miles just below the temperature at weather stations only. Cloud cover and cloud types are also plotted for weather stations, generally as in a standard national weather service plot. Ozone is analyzed in increments of 40 ppb on each map.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N. Mi.
100
002
043
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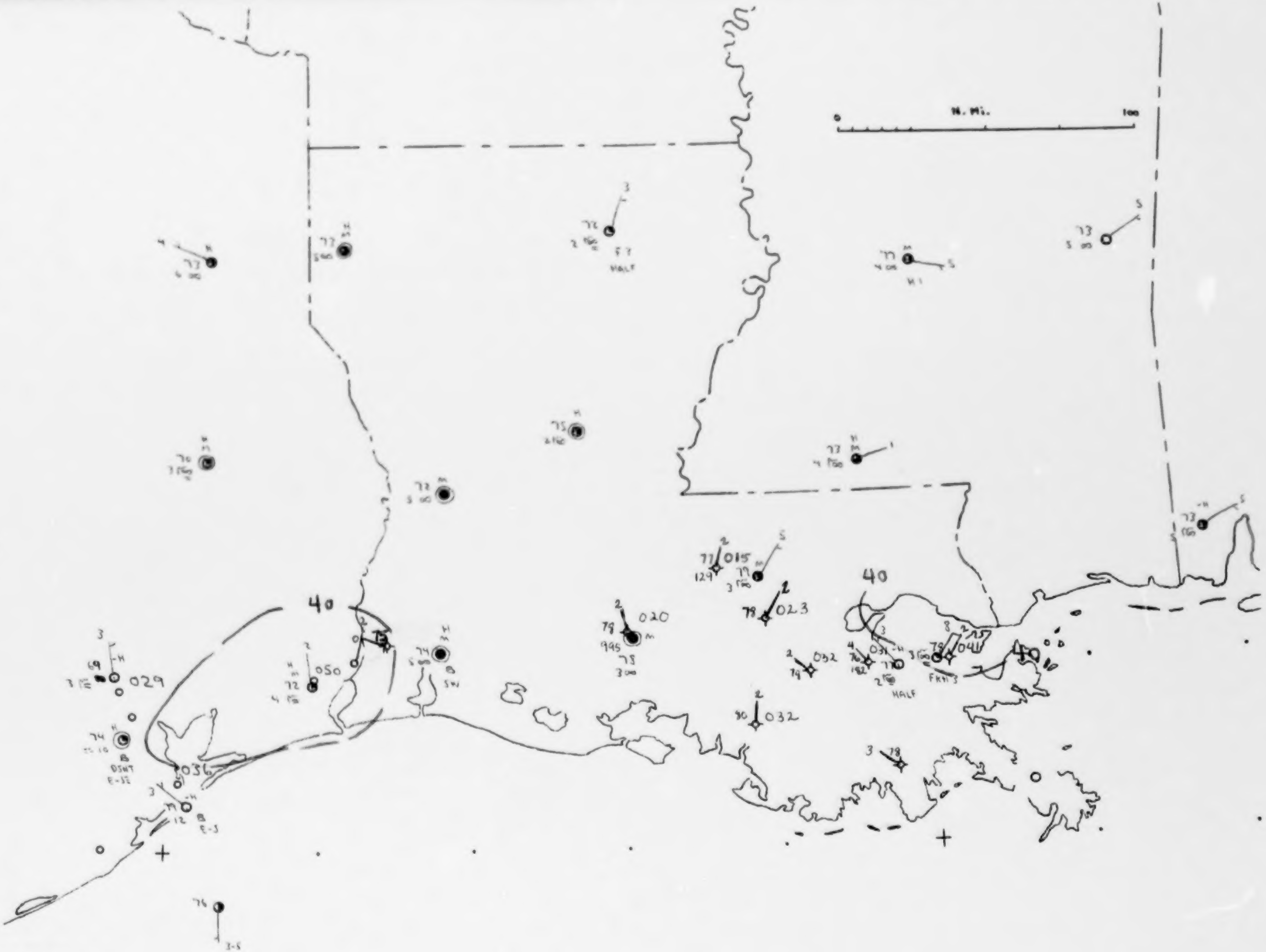
003
011
016
032
042
023
008
009
FKHZ

SURFACE OZONE AND WEATHER
8-25-76
07 CDT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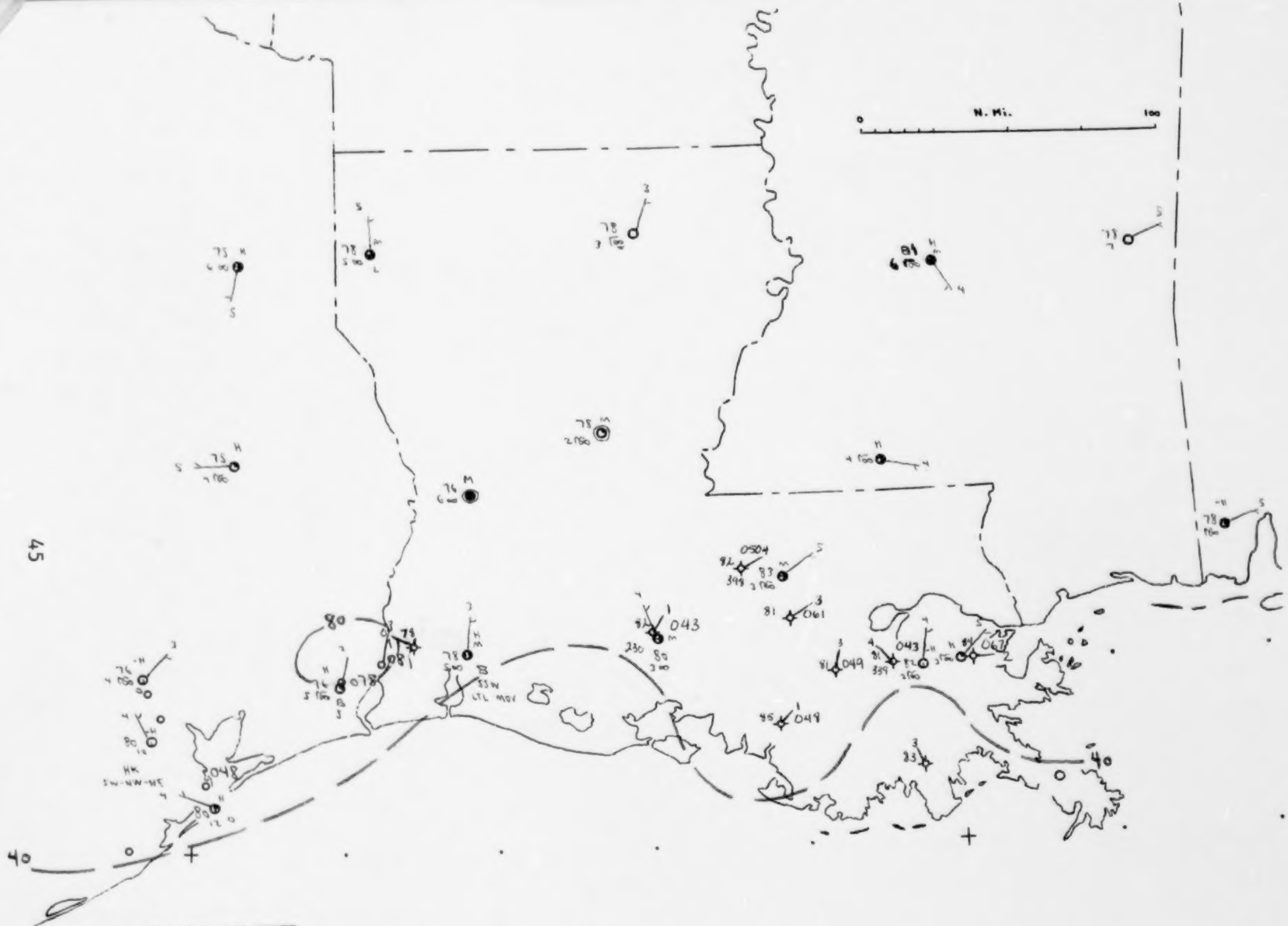
N. MI.
100
40
40
40
015
023
020
032
032
031
041
050
029
036
HALF
HALF
DSNT

8-25-76
08 CDT
SURFACE OZONE AND WEATHER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80
40
40
043
043
061
061
049
049
048
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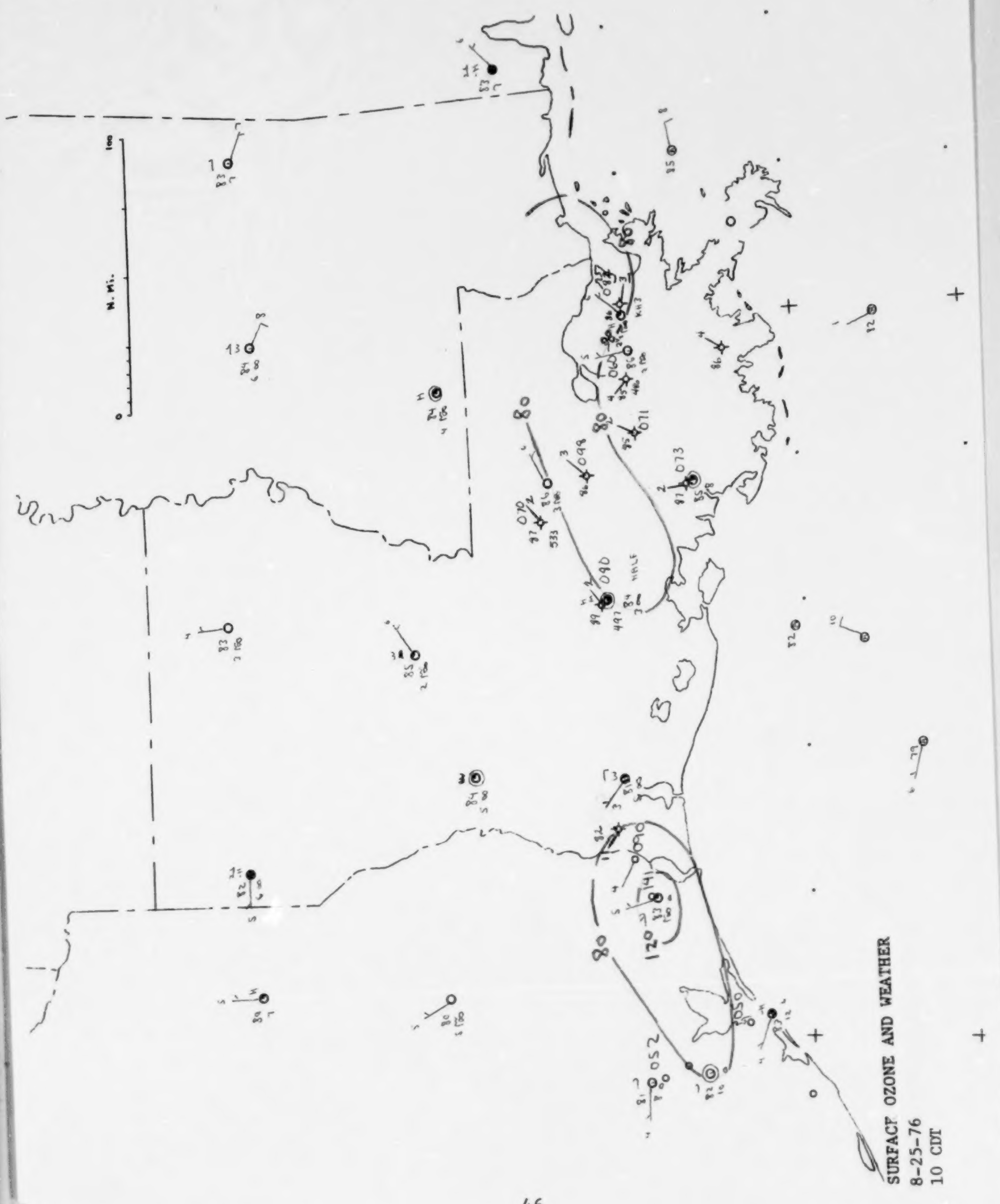
081
0504
SSW
LTL MOV
HK
SW-NN-NE

SURFACE OZONE AND WEATHER
8-25-76
09 CDT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100
80
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120
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073
011
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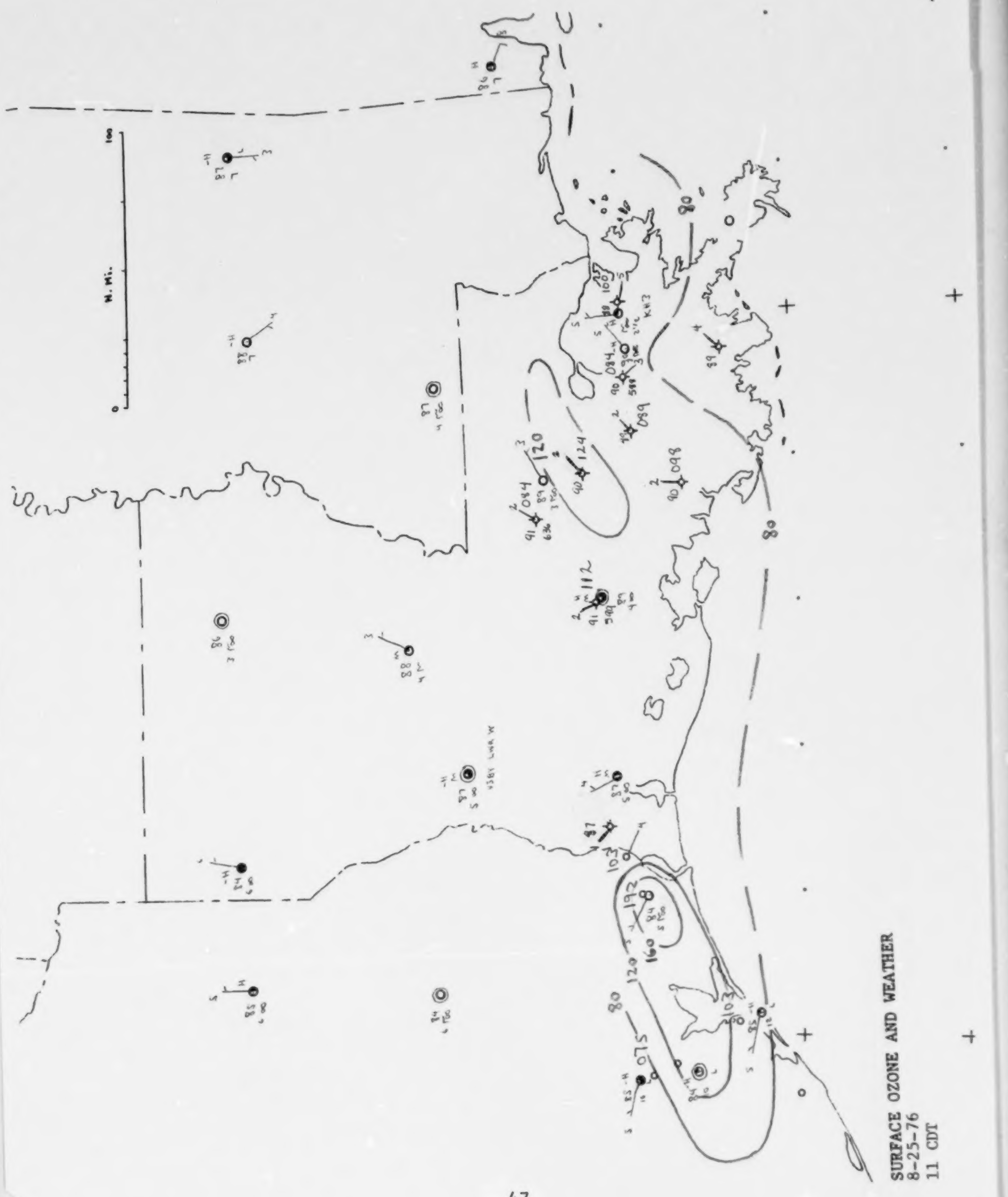
052
050
533
497

SURFACE OZONE AND WEATHER
8-25-76
10 CDT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80
80
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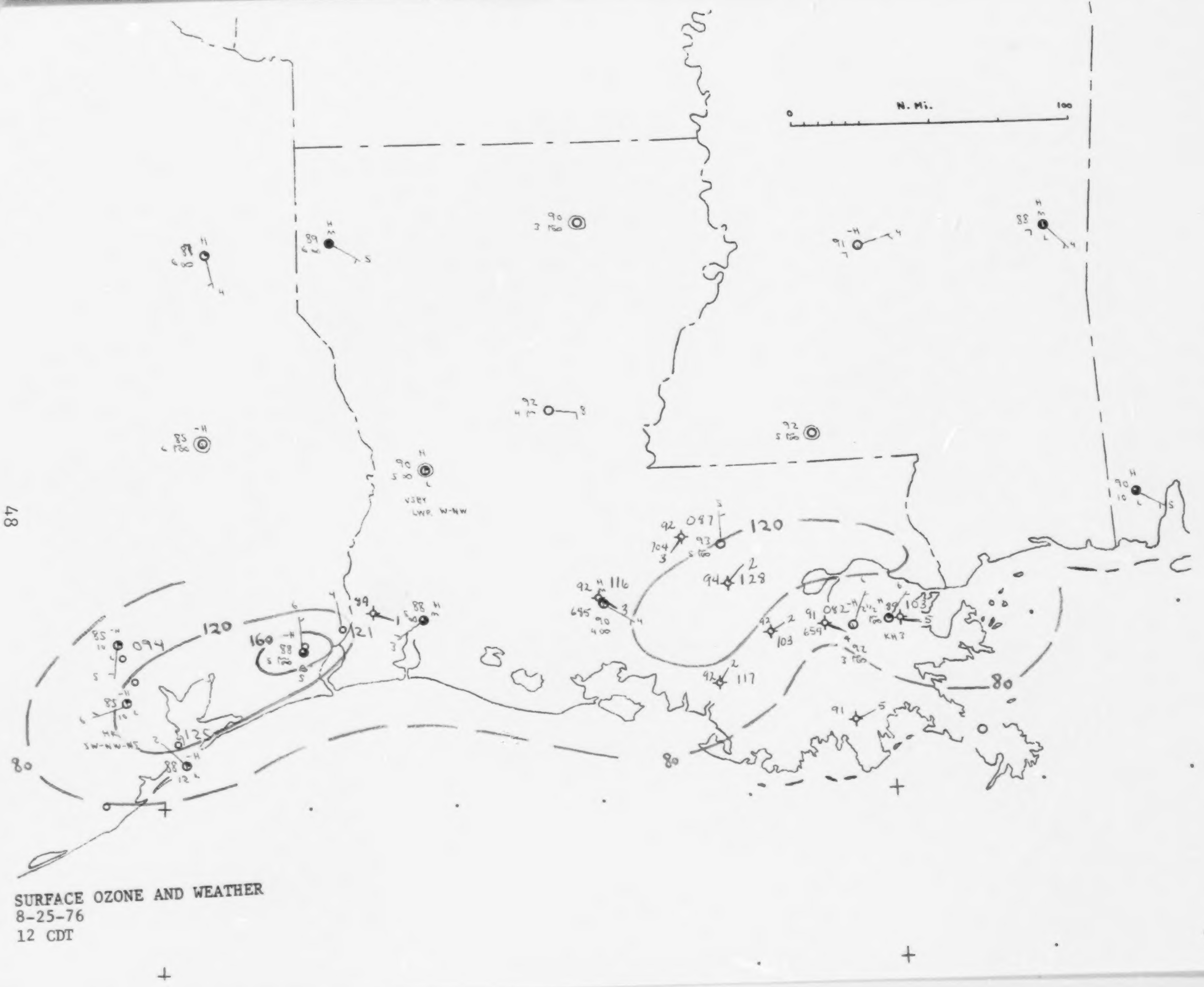
8-25-76
11 CDT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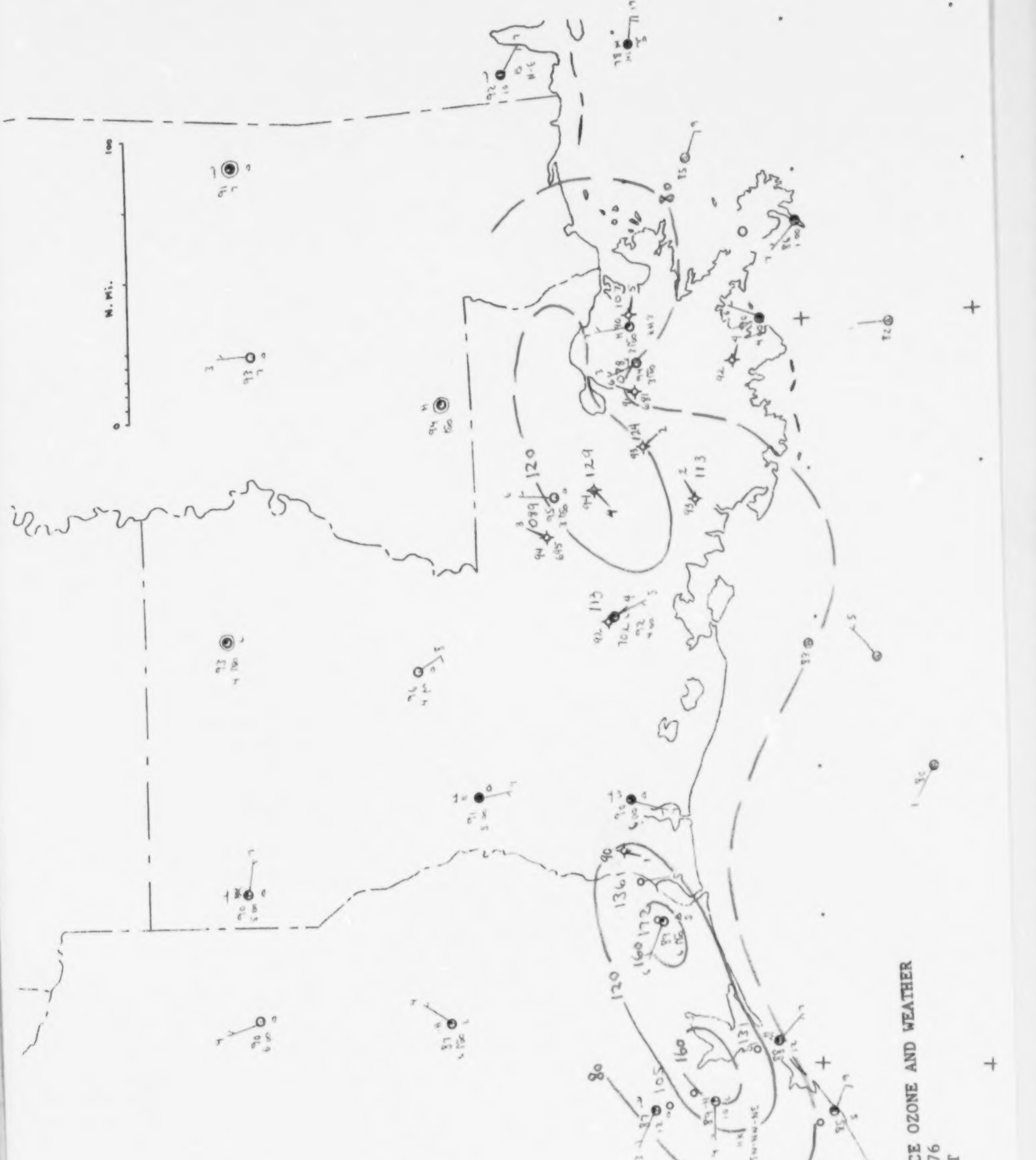
103
659
685

SURFACE OZONE AND WEATHER
8-25-76
12 CDT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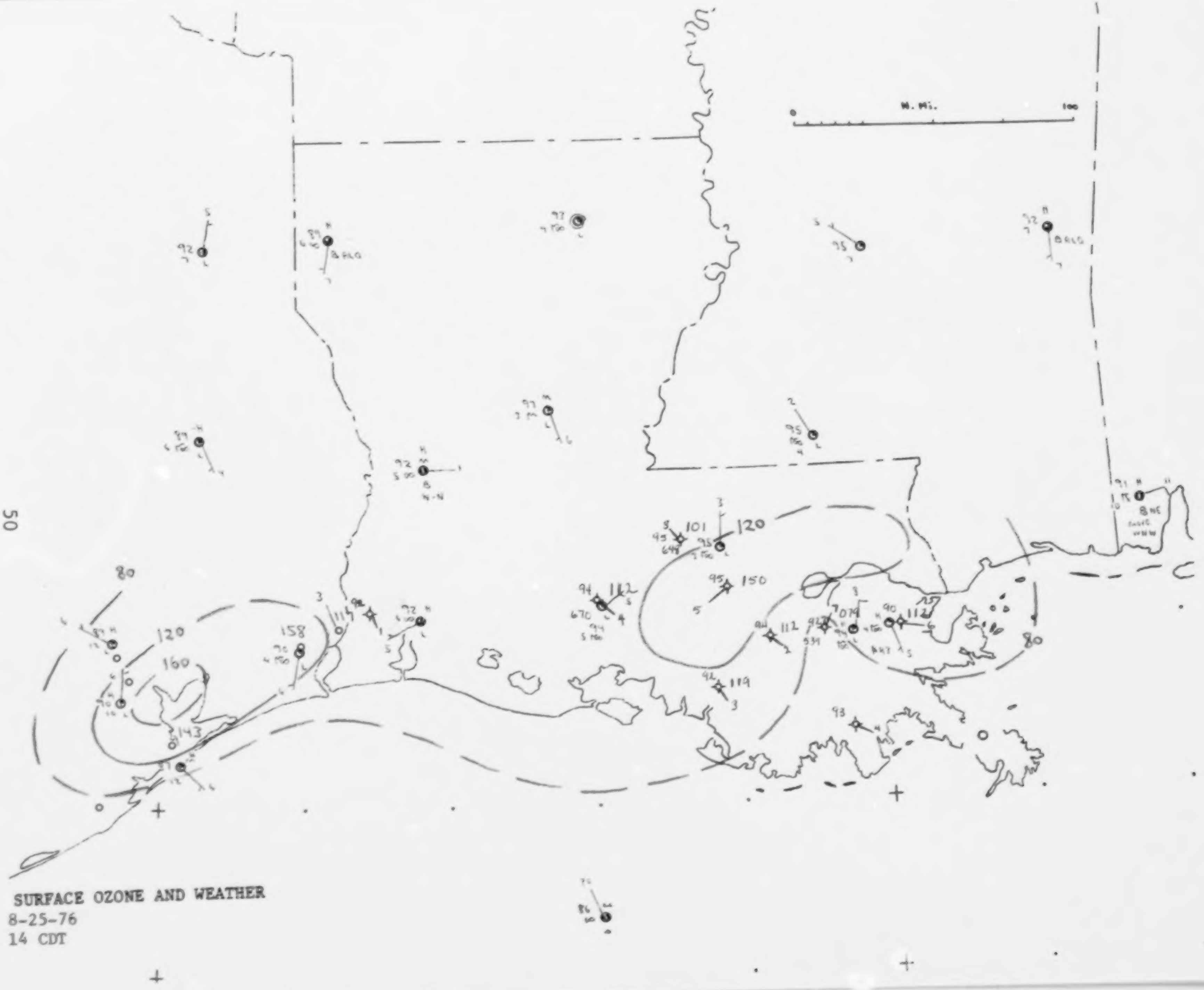
8-25-76
13 CDT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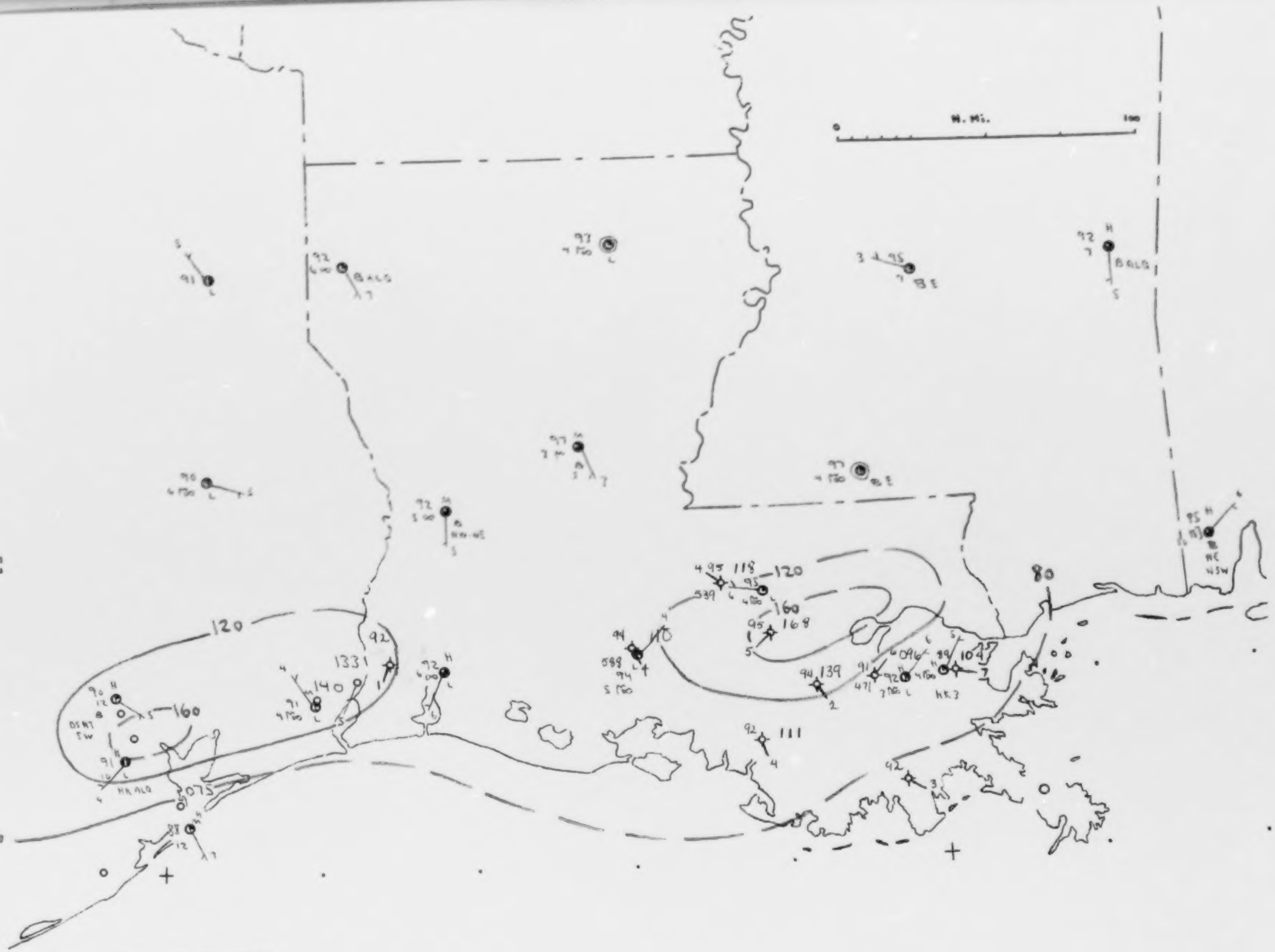
SURFACE OZONE AND WEATHER
8-25-76
14 CDT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075

SURFACE OZONE AND WEATHER
8-25-76
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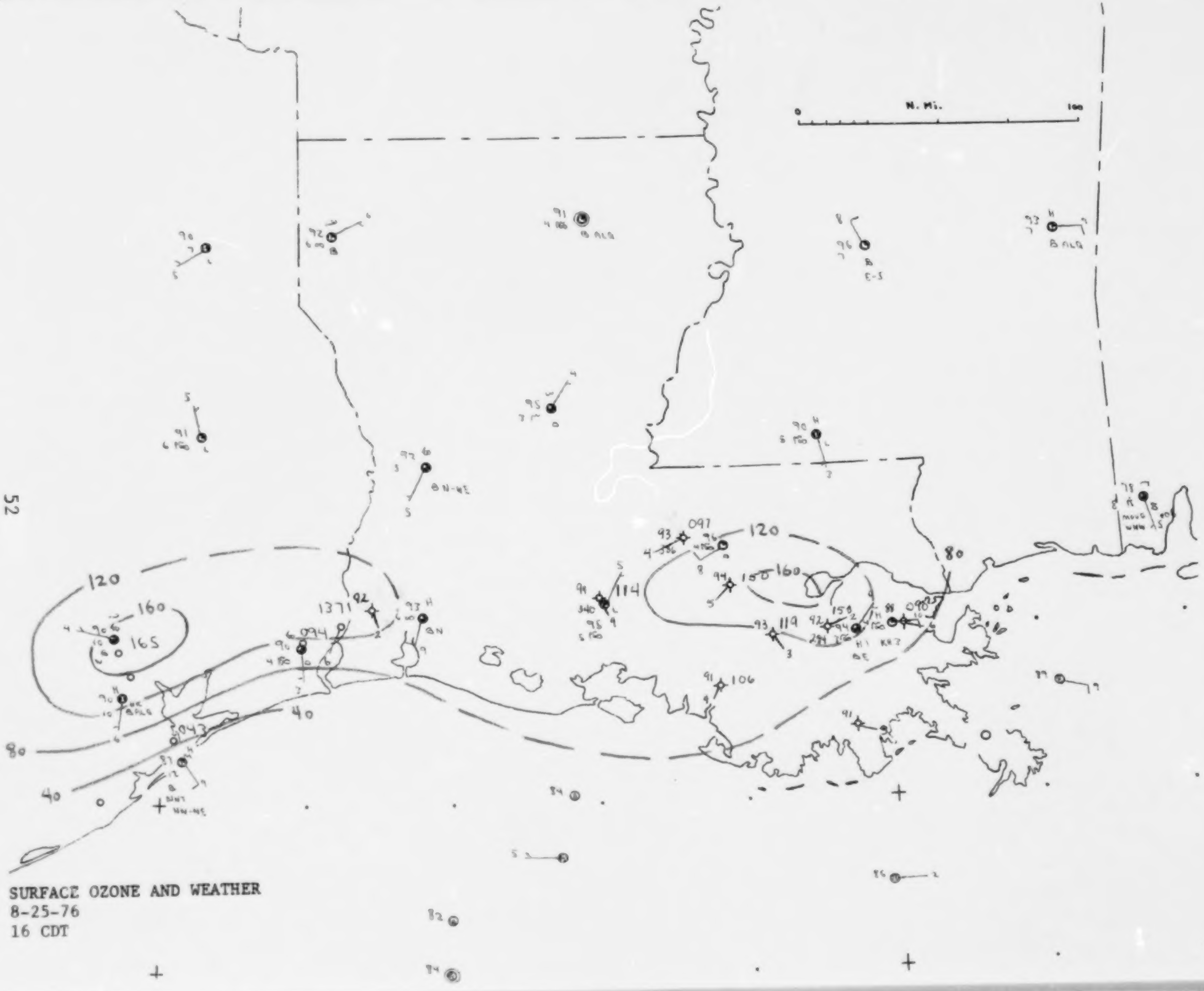
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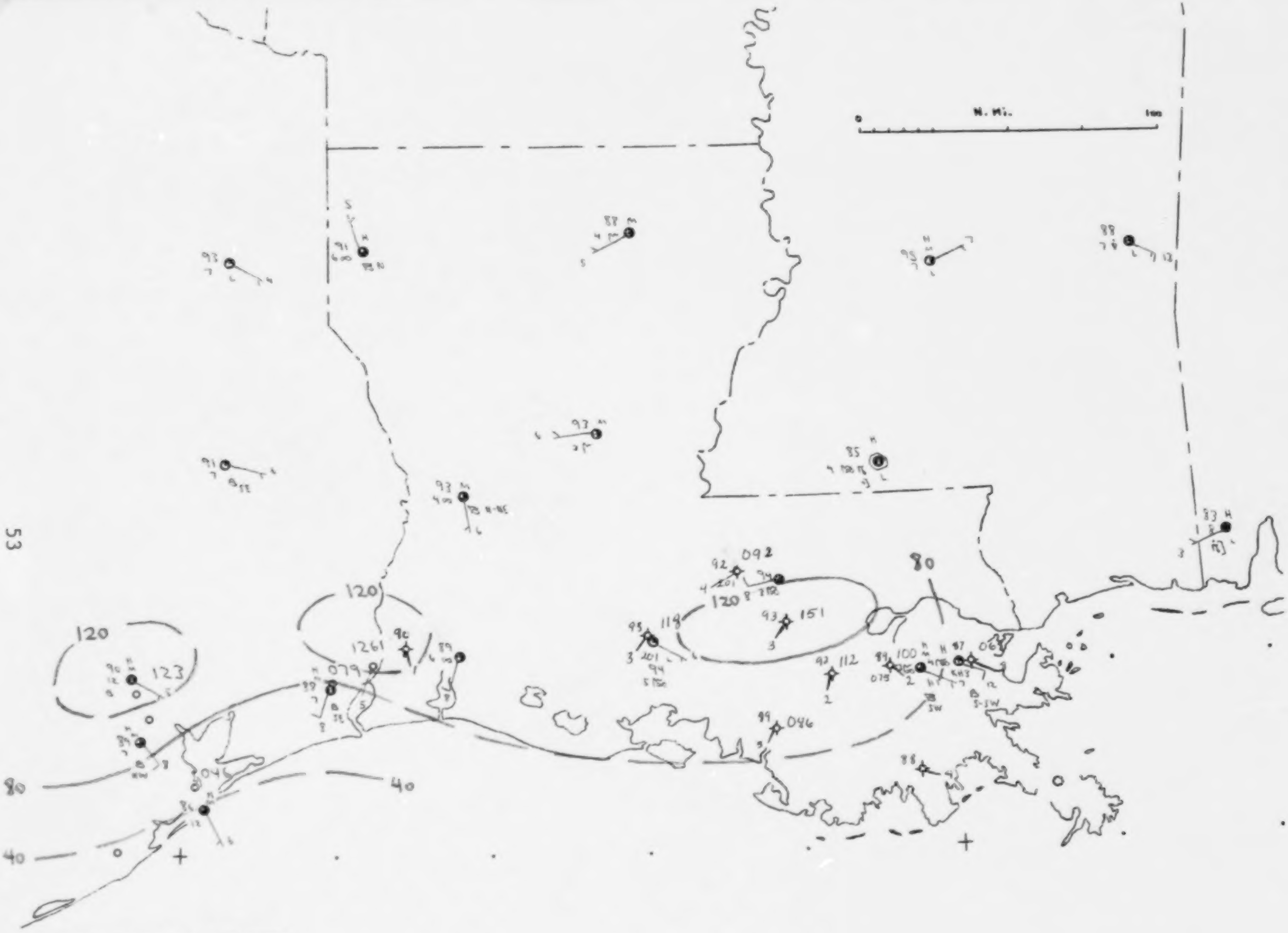
090

SURFACE OZONE AND WEATHER
8-25-76
16 CDT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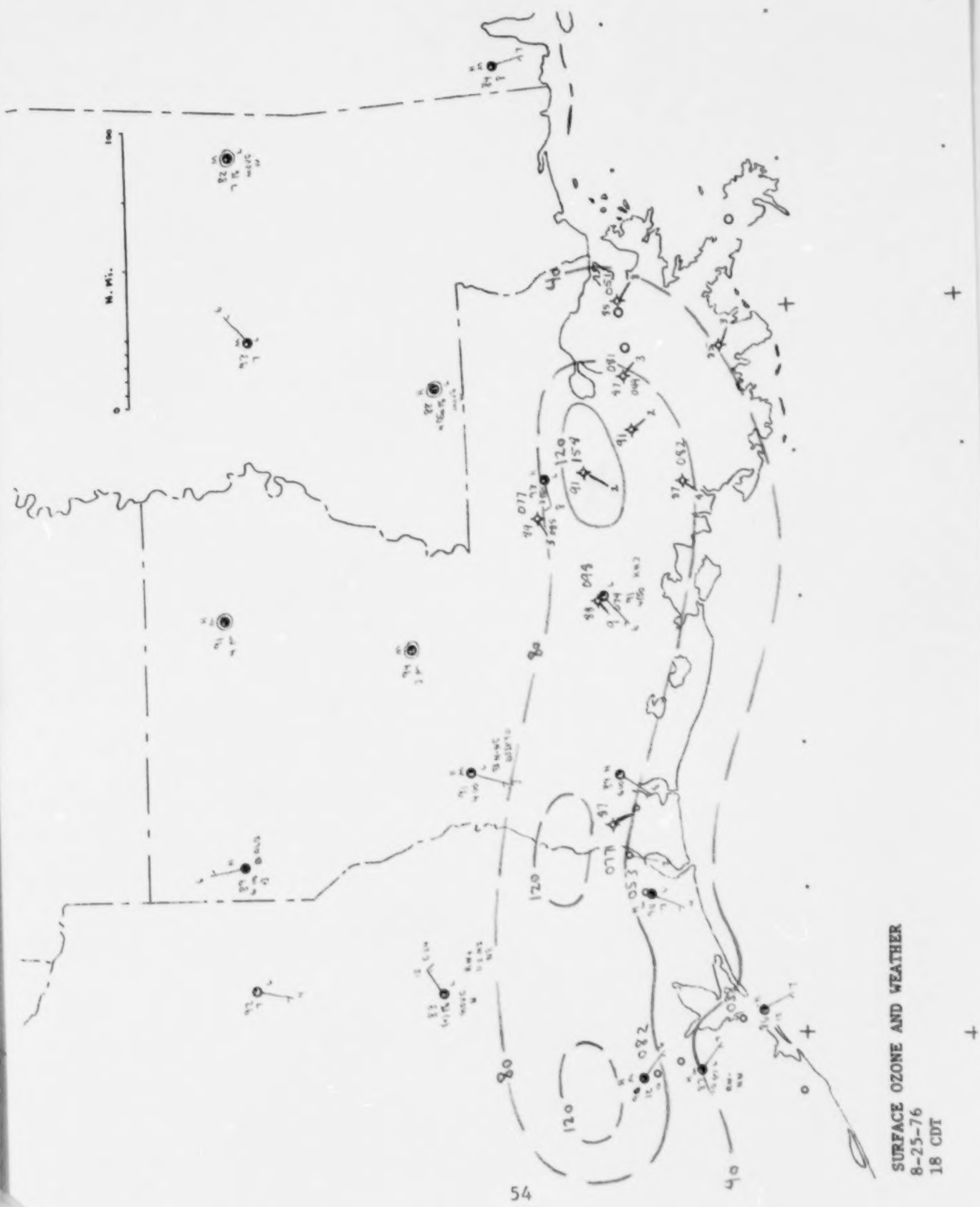
SURFACE OZONE AND WEATHER
8-25-76
17 CDT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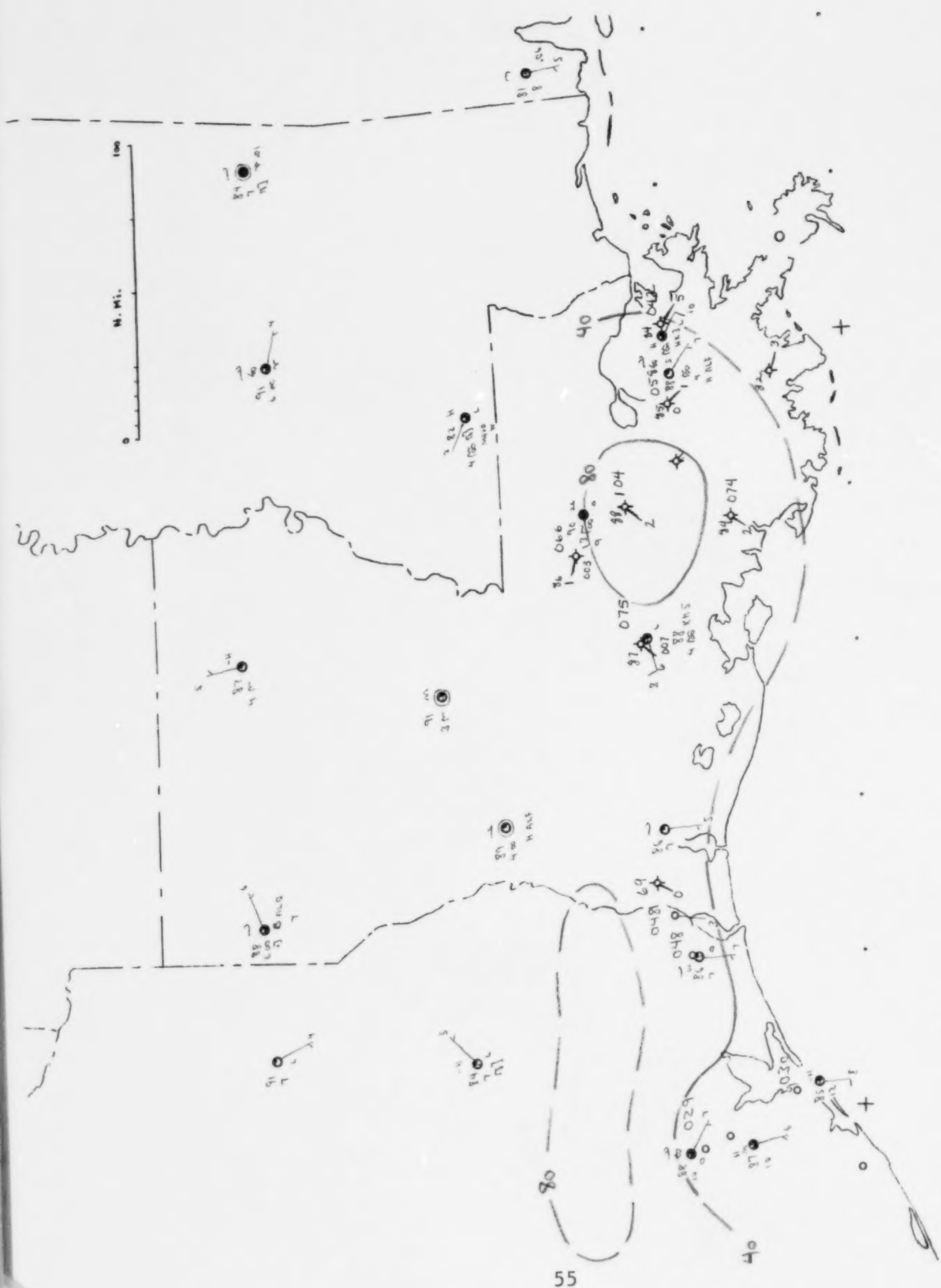
SURFACE OZONE AND WEATHER
8-25-76
18 CDT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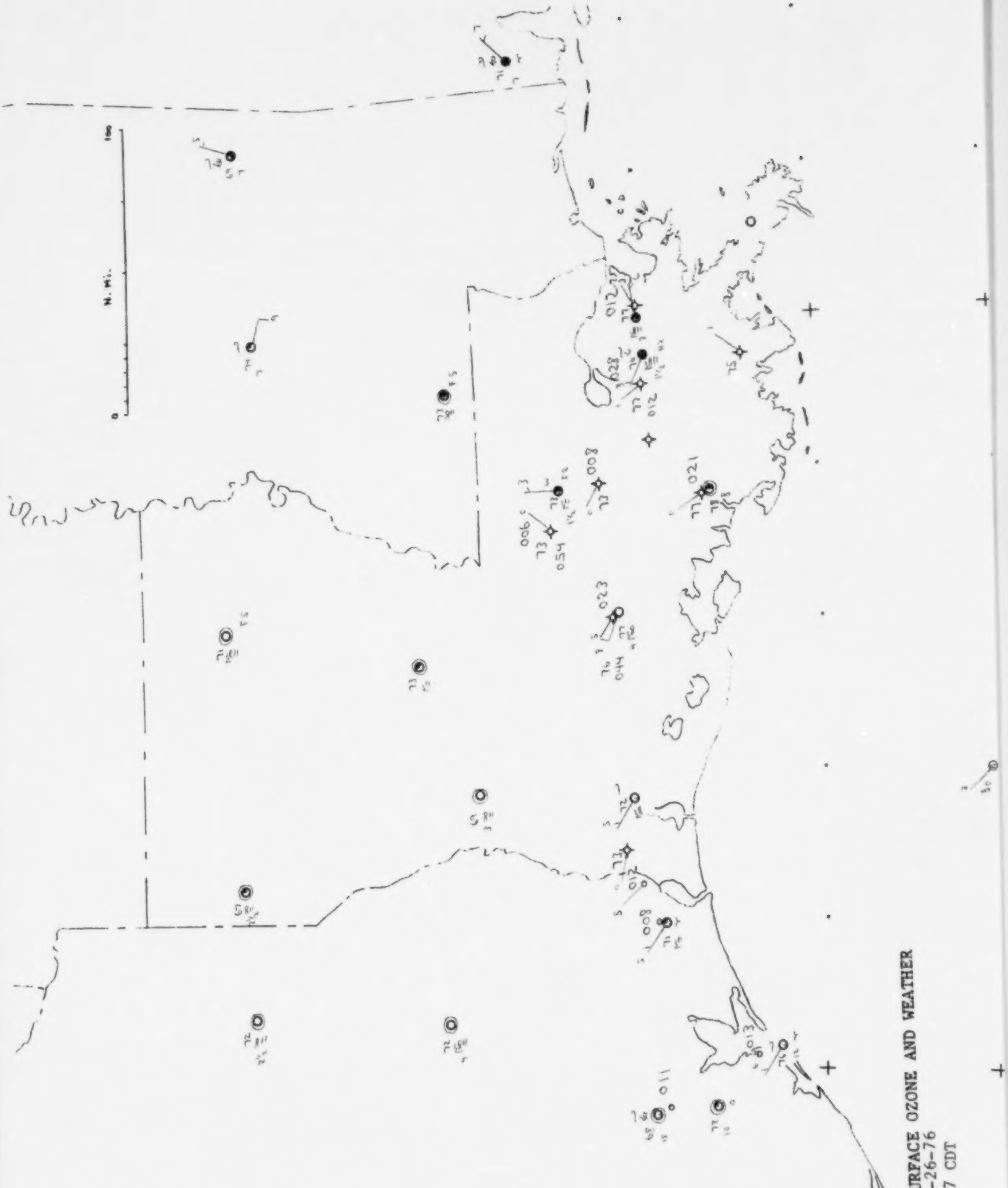
8-25-76
19 CDT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021
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013
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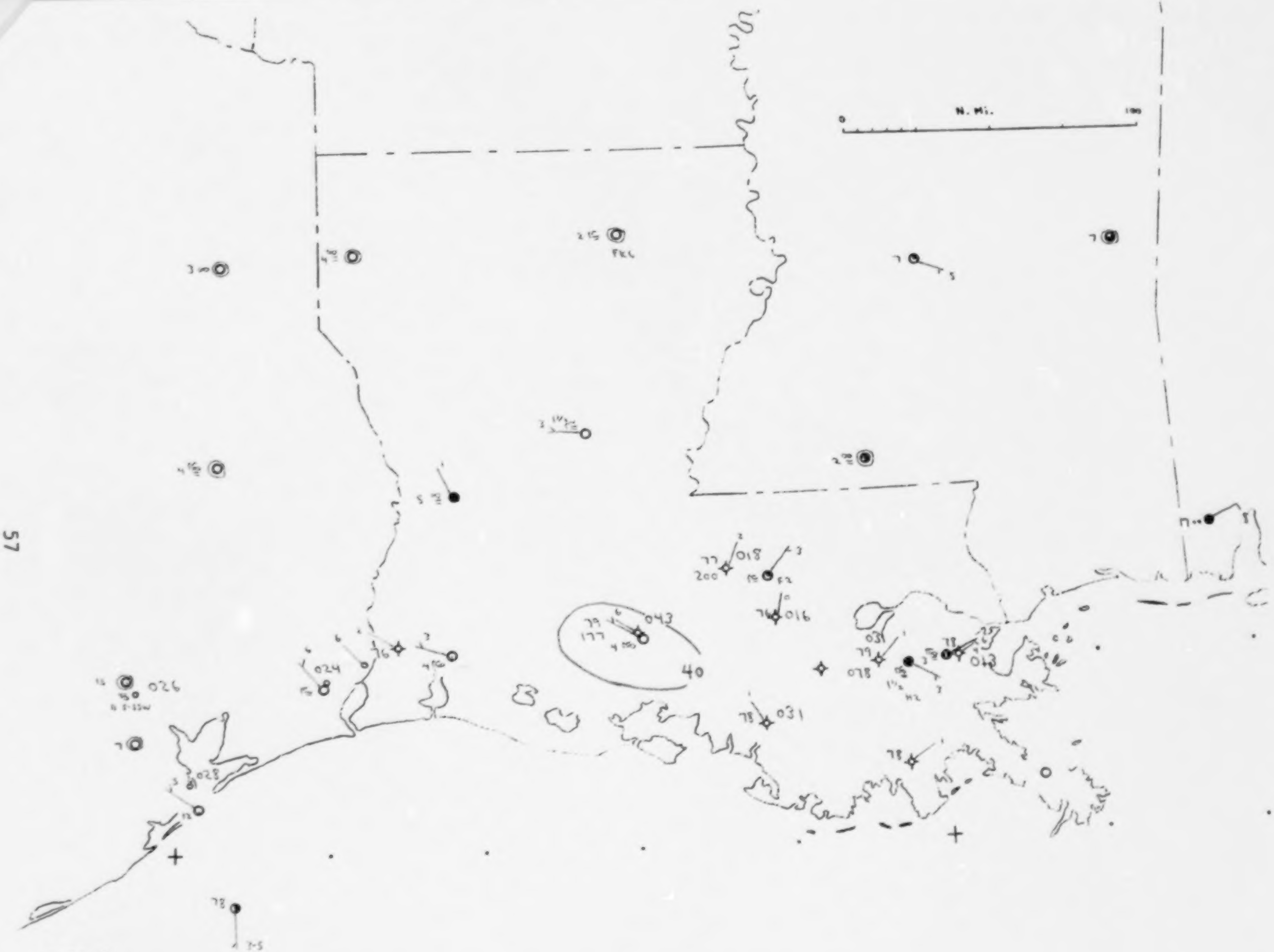
SURFACE OZONE AND WEATHER
8-26-76
07 CDT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8-26-76
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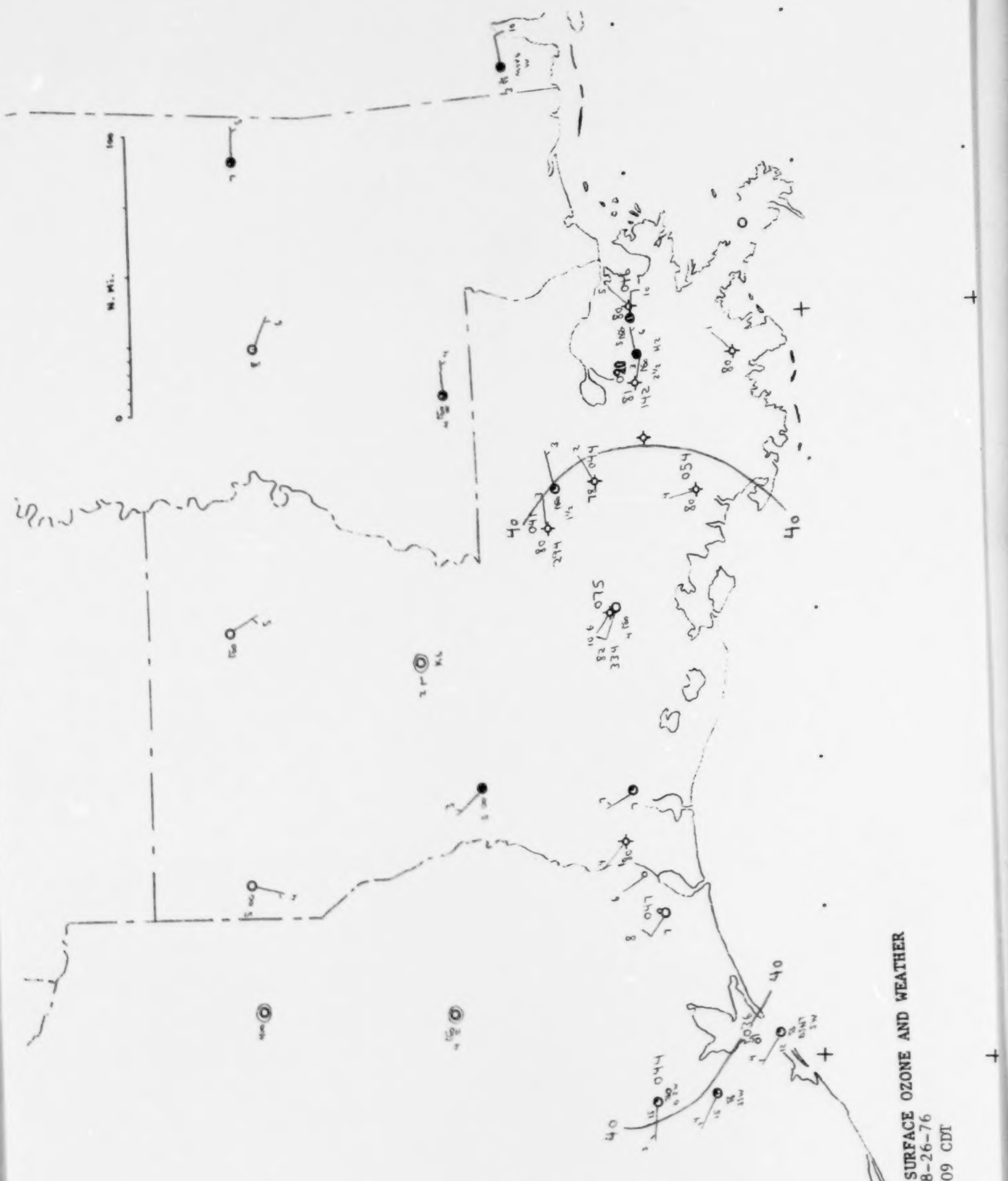
SURFACE OZONE AND WEATHER



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SURFACE OZONE AND WEATHER
8-26-76
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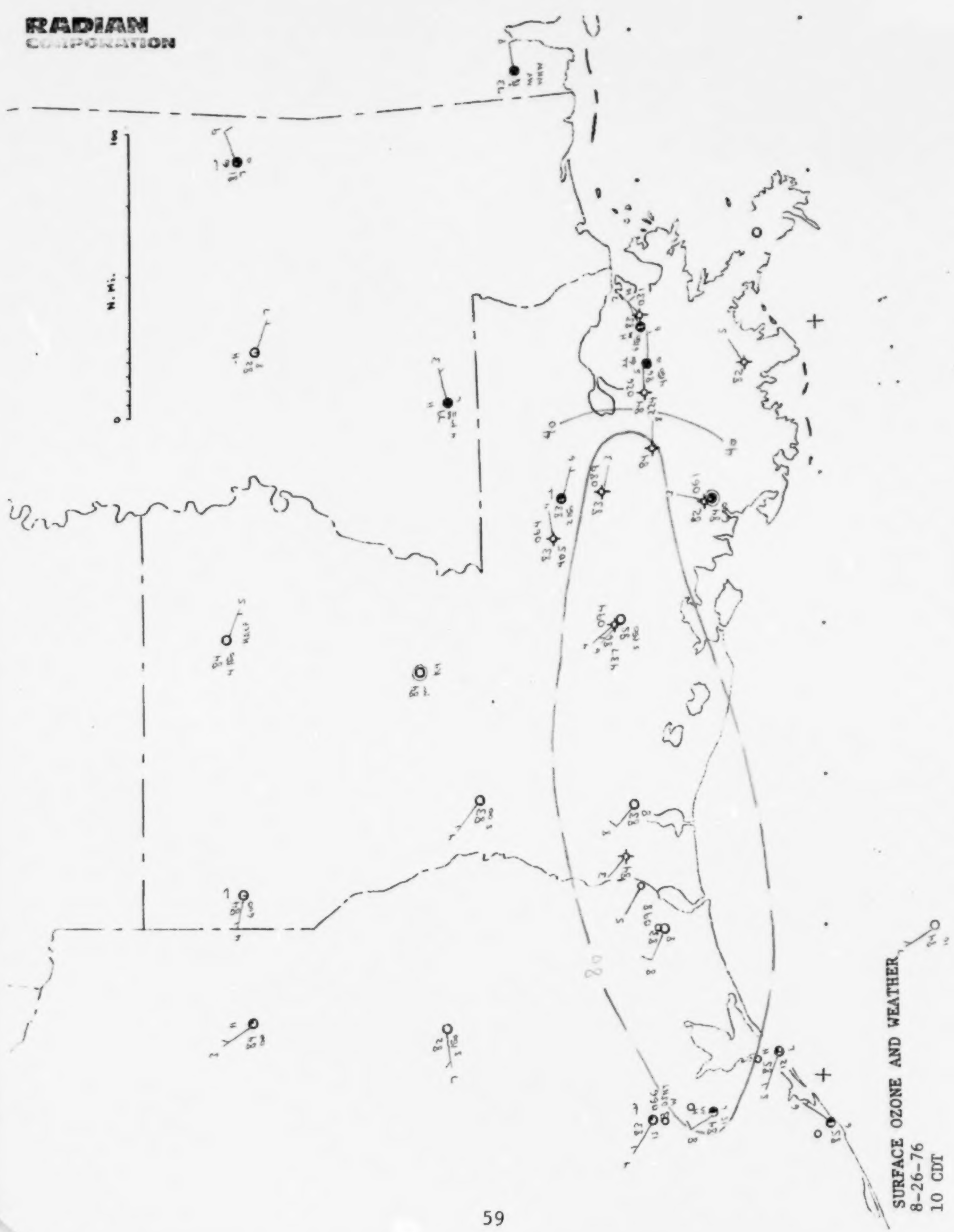
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SURFACE OZONE AND WEATHER
8-26-76
10 CDT

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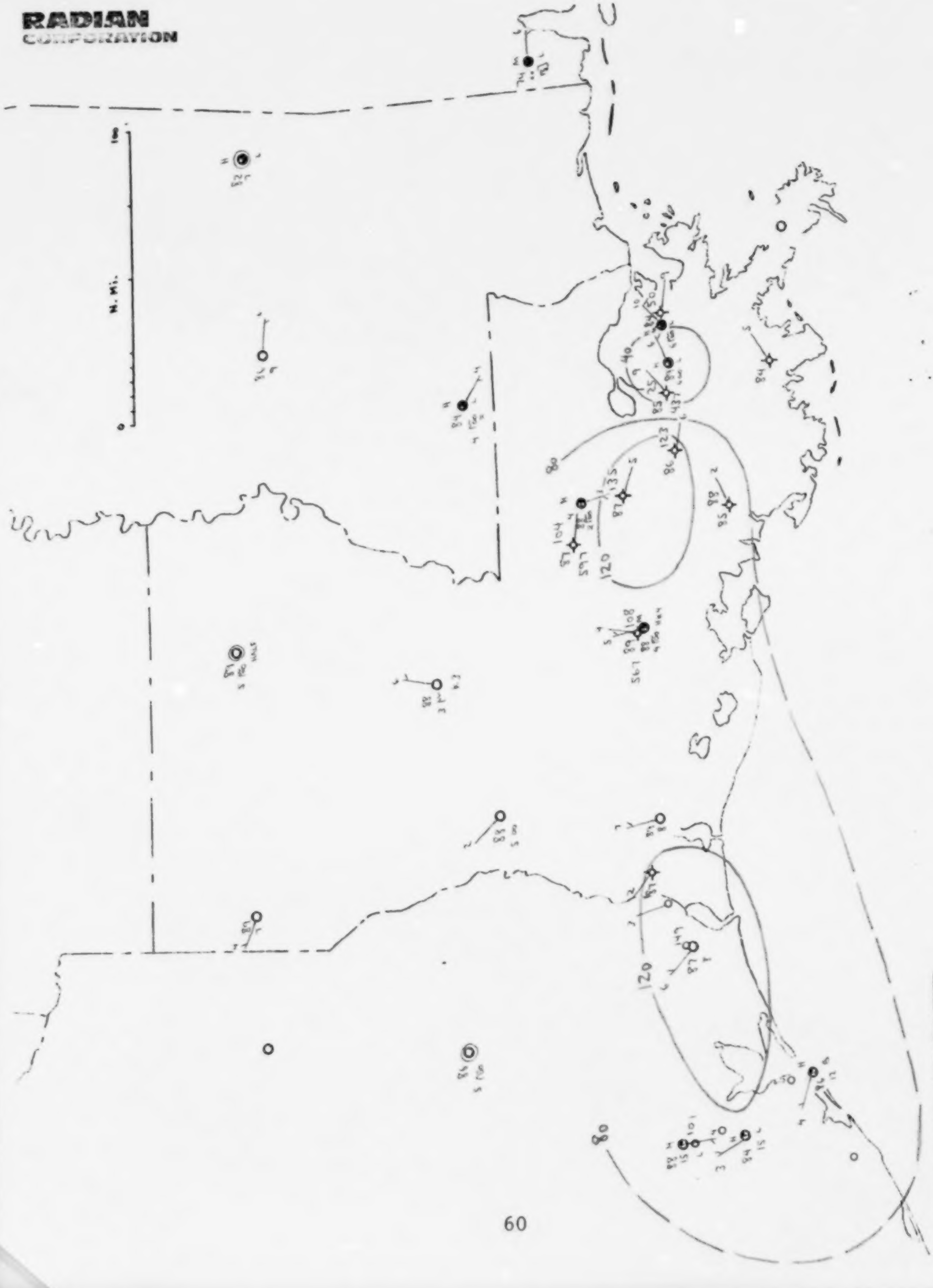
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SURFACE OZONE AND WEATHER
8-26-76
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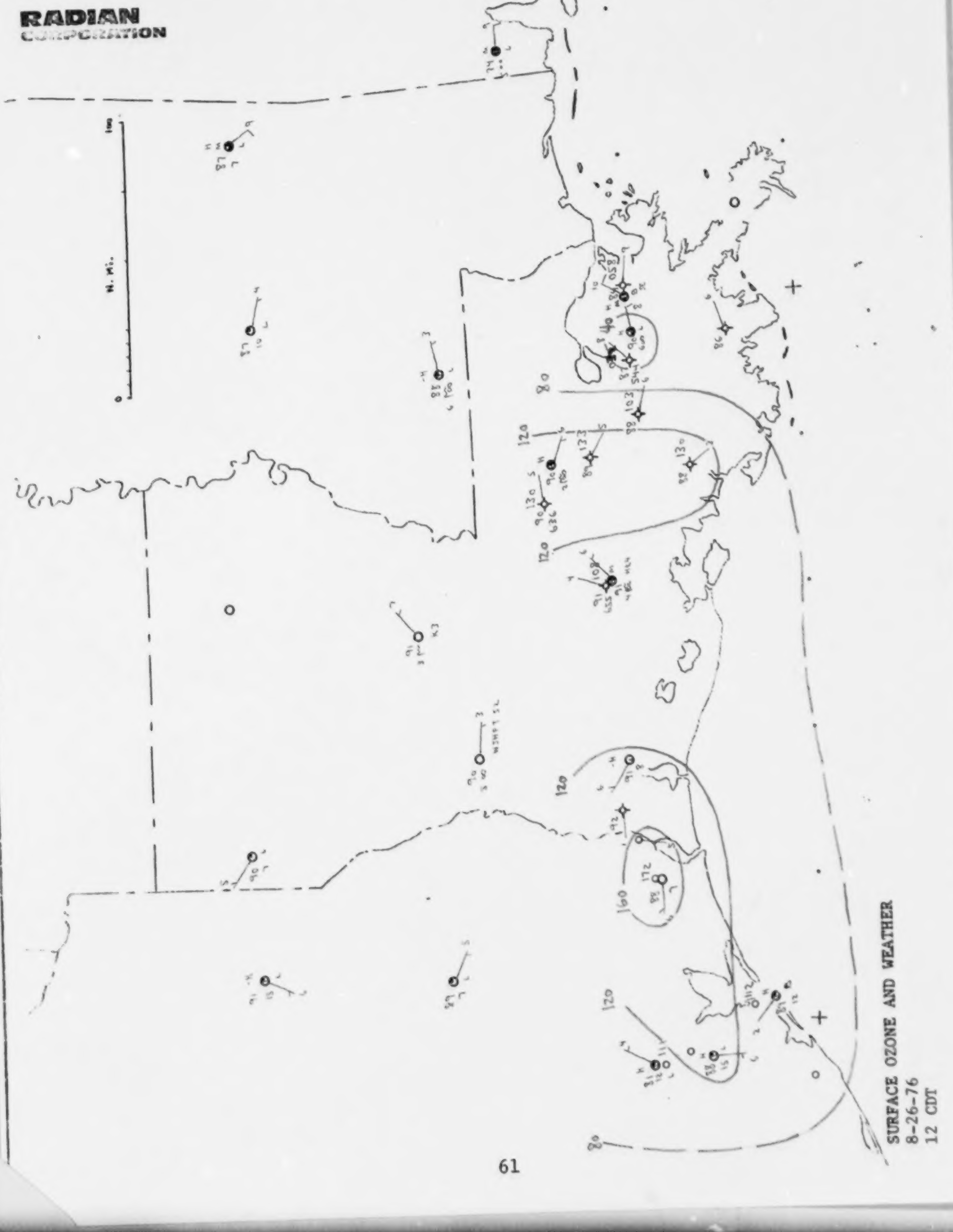
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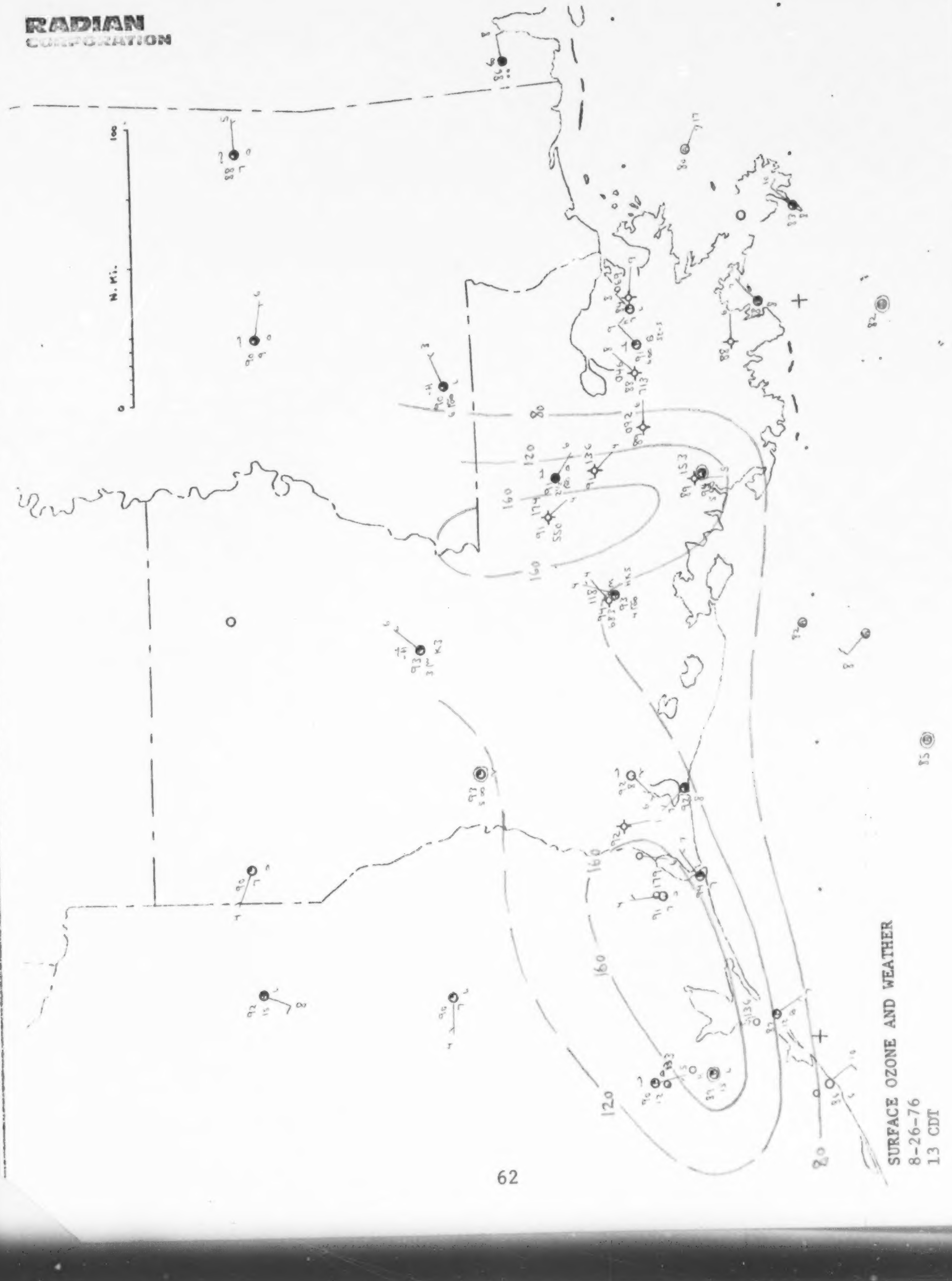
SURFACE OZONE AND WEATHER
8-26-76
12 CDT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SURFACE OZONE AND WEATHER
8-26-76
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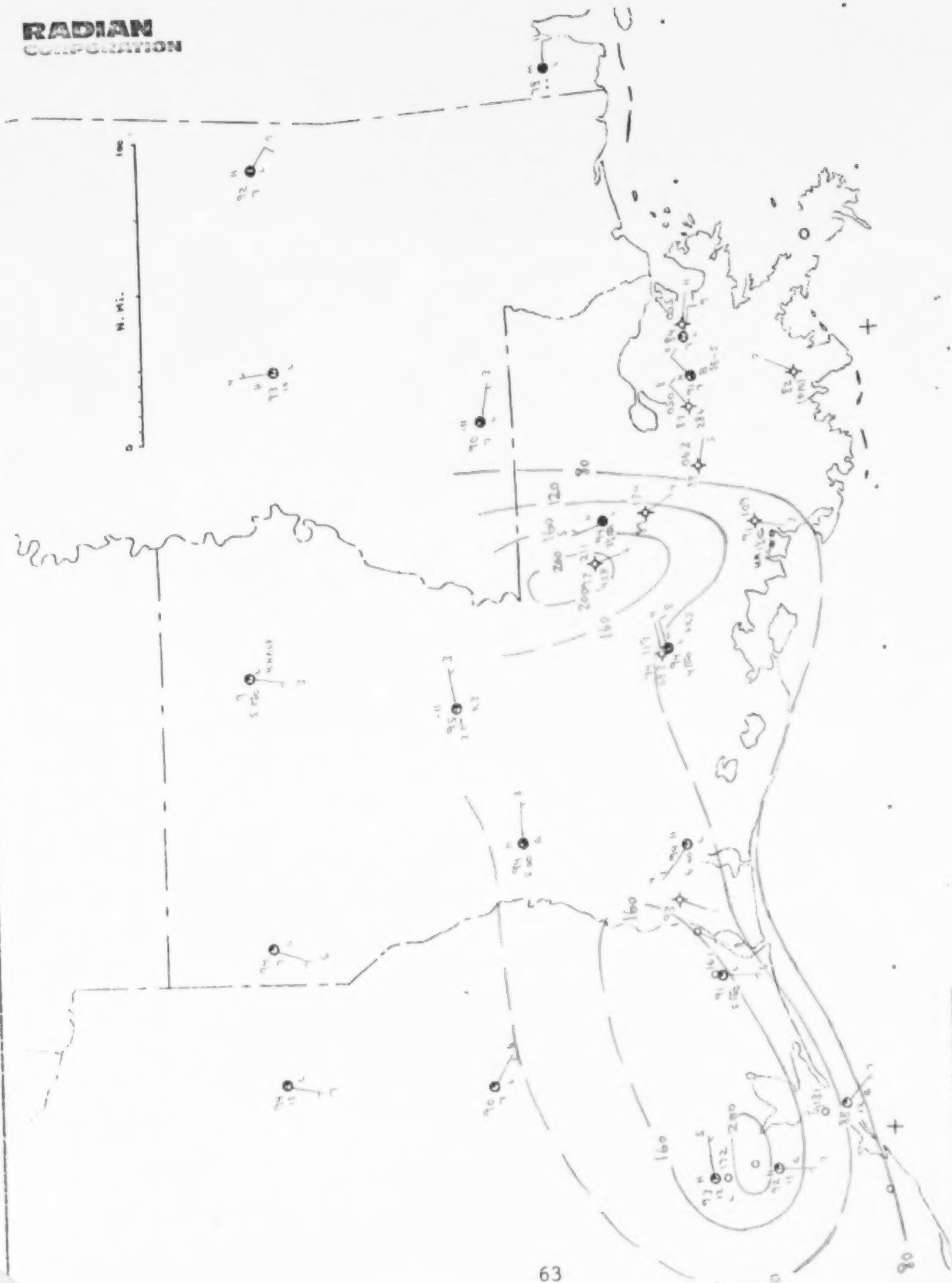
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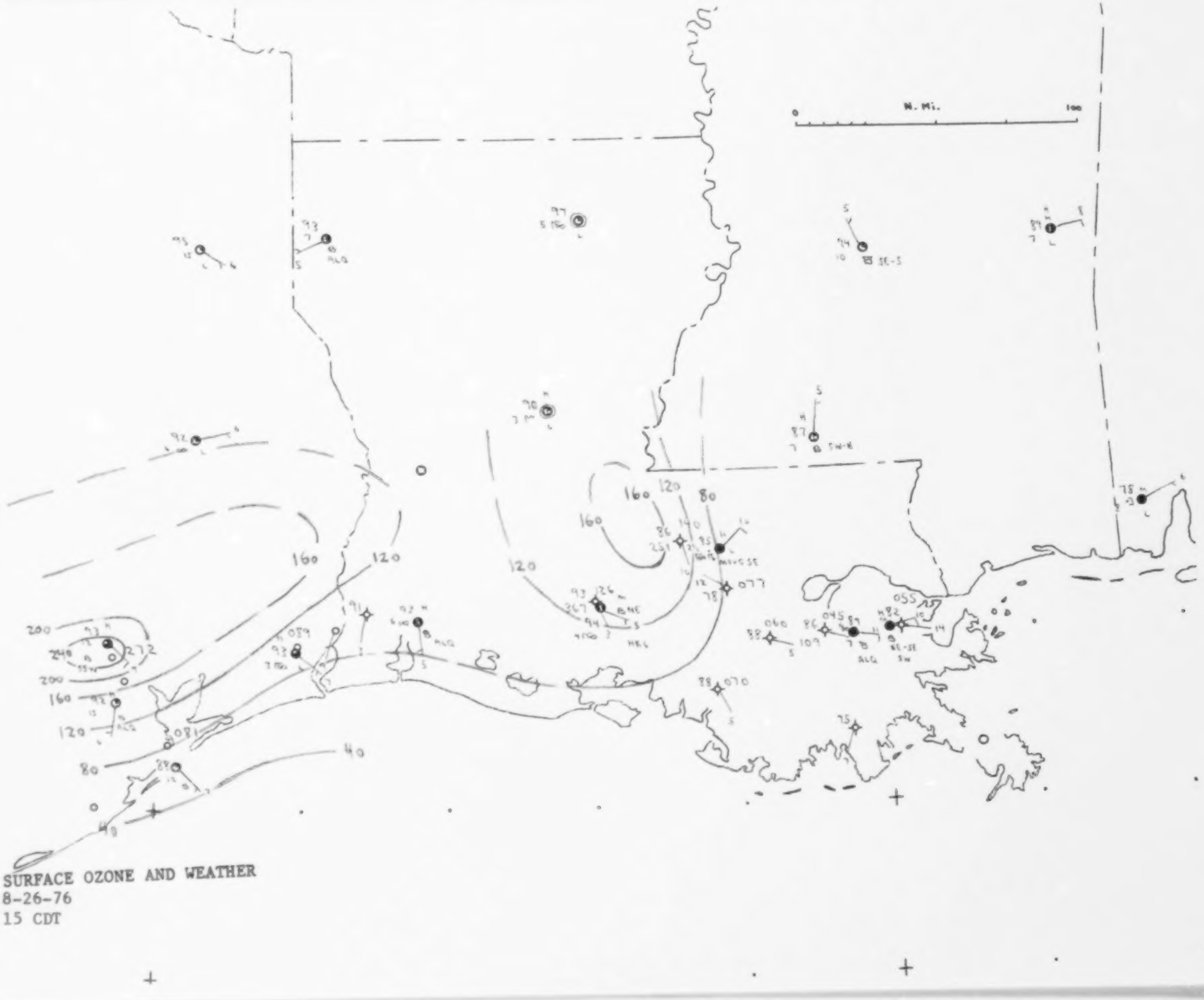
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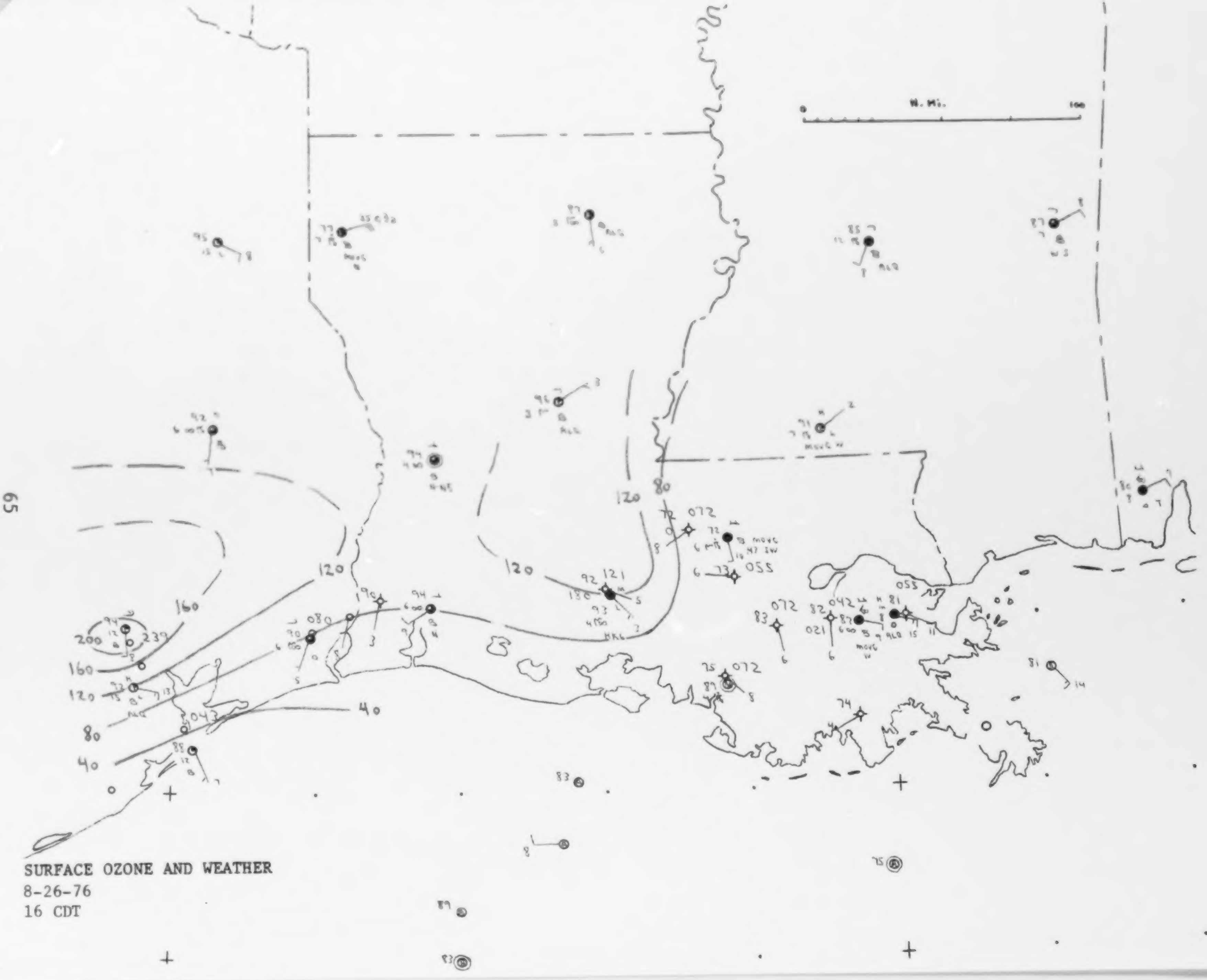
SURFACE OZONE AND WEATHER
8-26-76
15 CDT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SURFACE OZONE AND WEATHER
8-26-76
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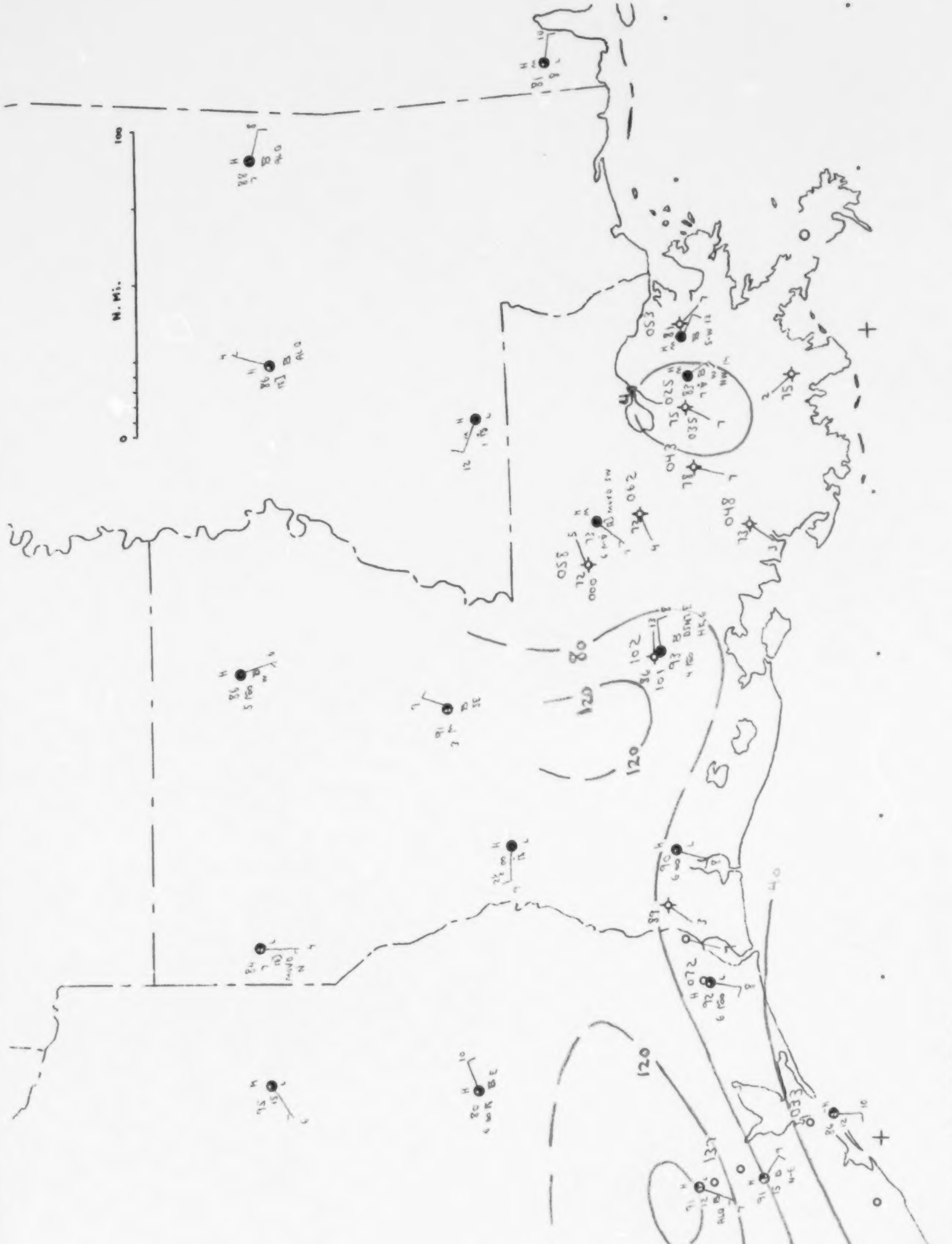
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SURFACE OZONE AND WEATHER
8-26-76
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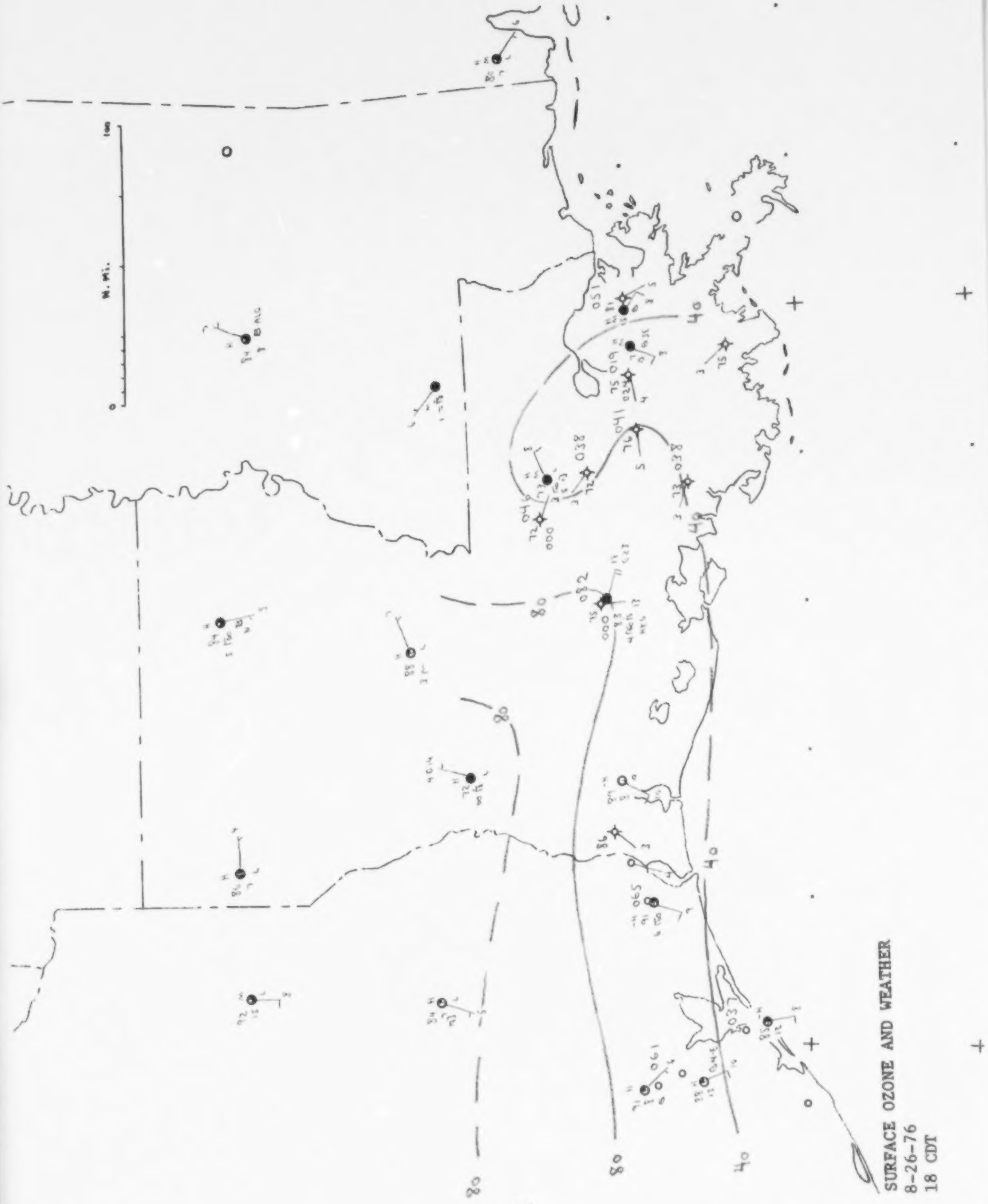
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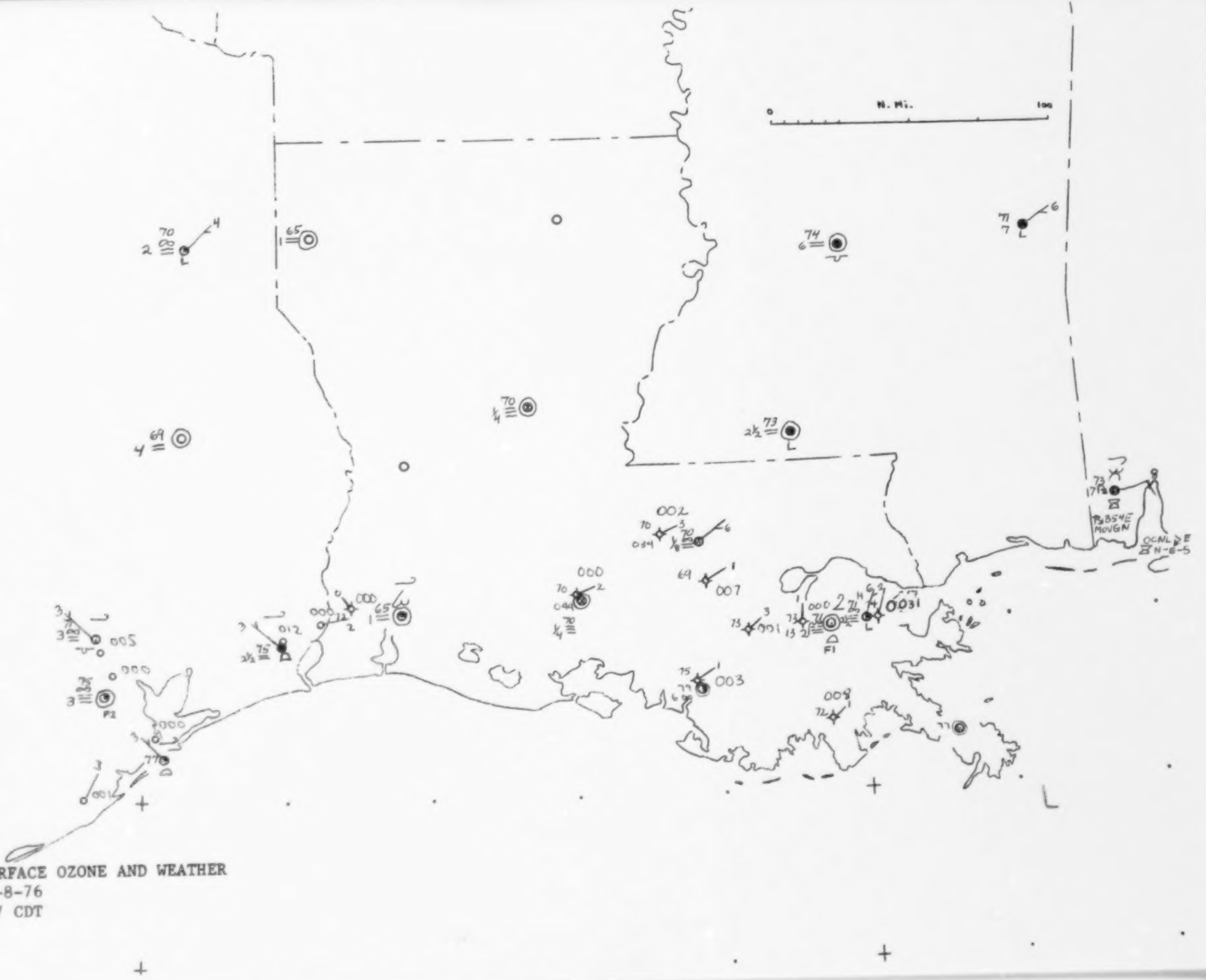
SURFACE OZONE AND WEATHER
8-26-76
18 CDT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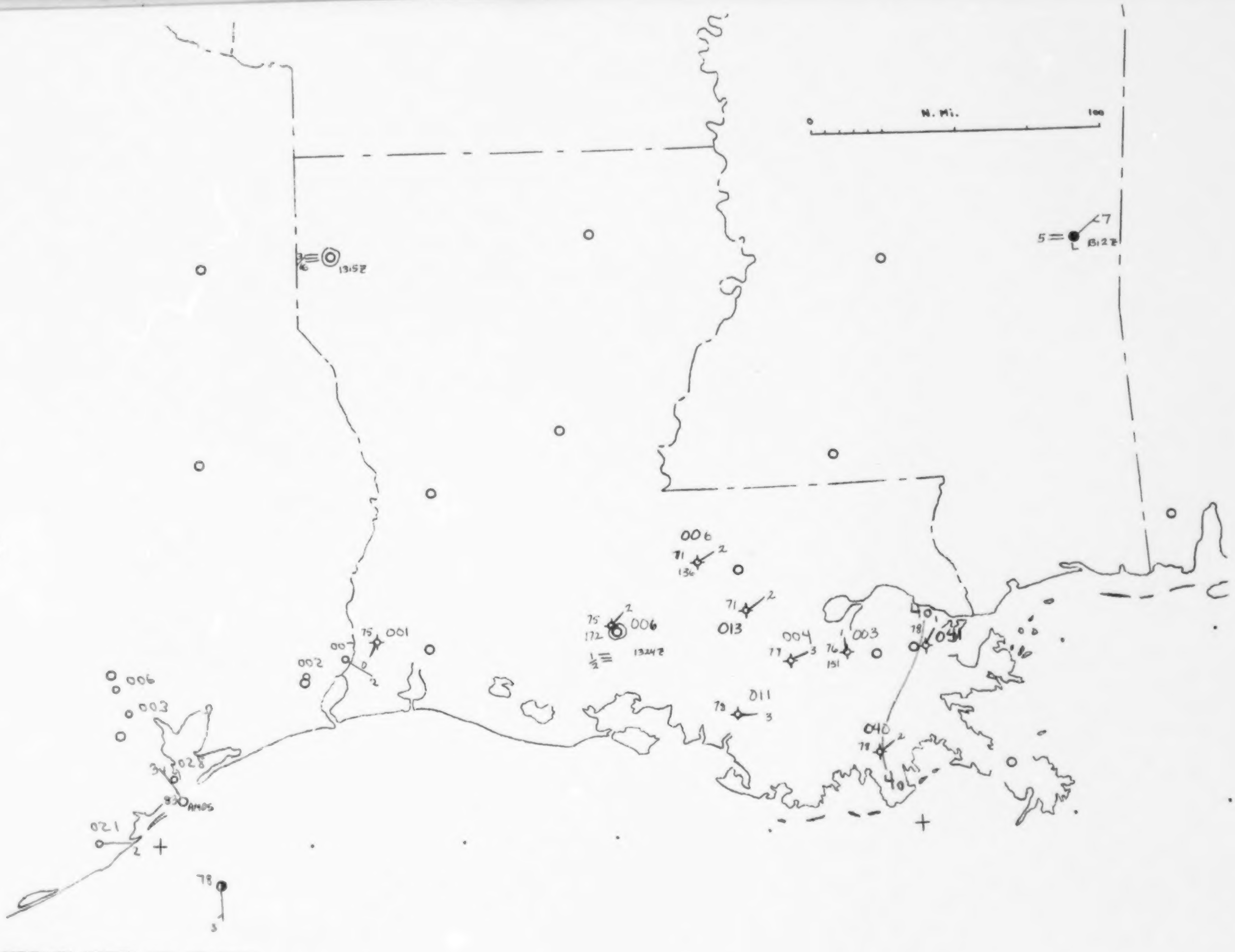
034
001

SURFACE OZONE AND WEATHER
9-8-76
07 CDT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041
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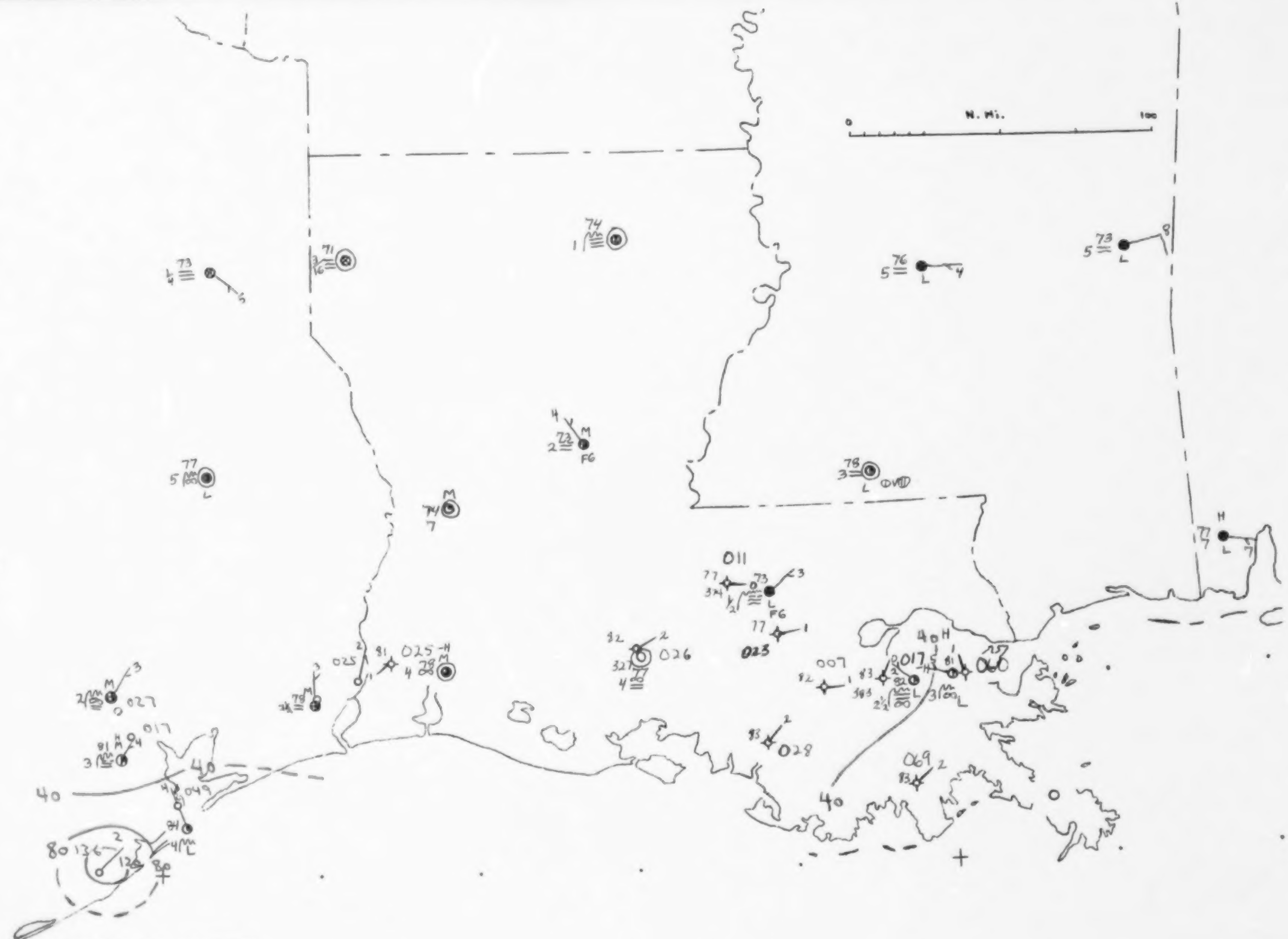
B12Z

SURFACE OZONE AND WEATHER
9-8-76
08 CDT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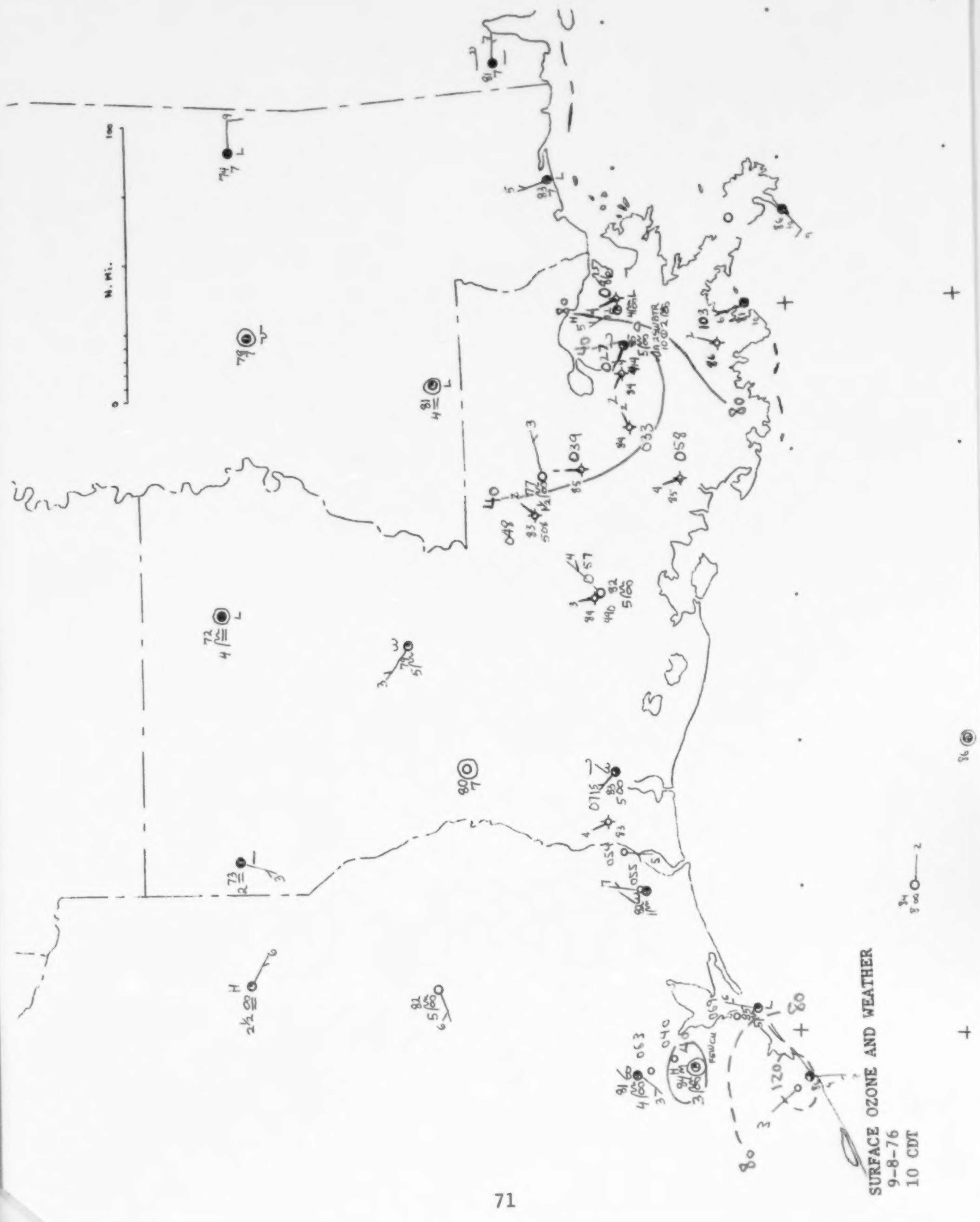
126

SURFACE OZONE AND WEATHER
9-8-76
09 CDT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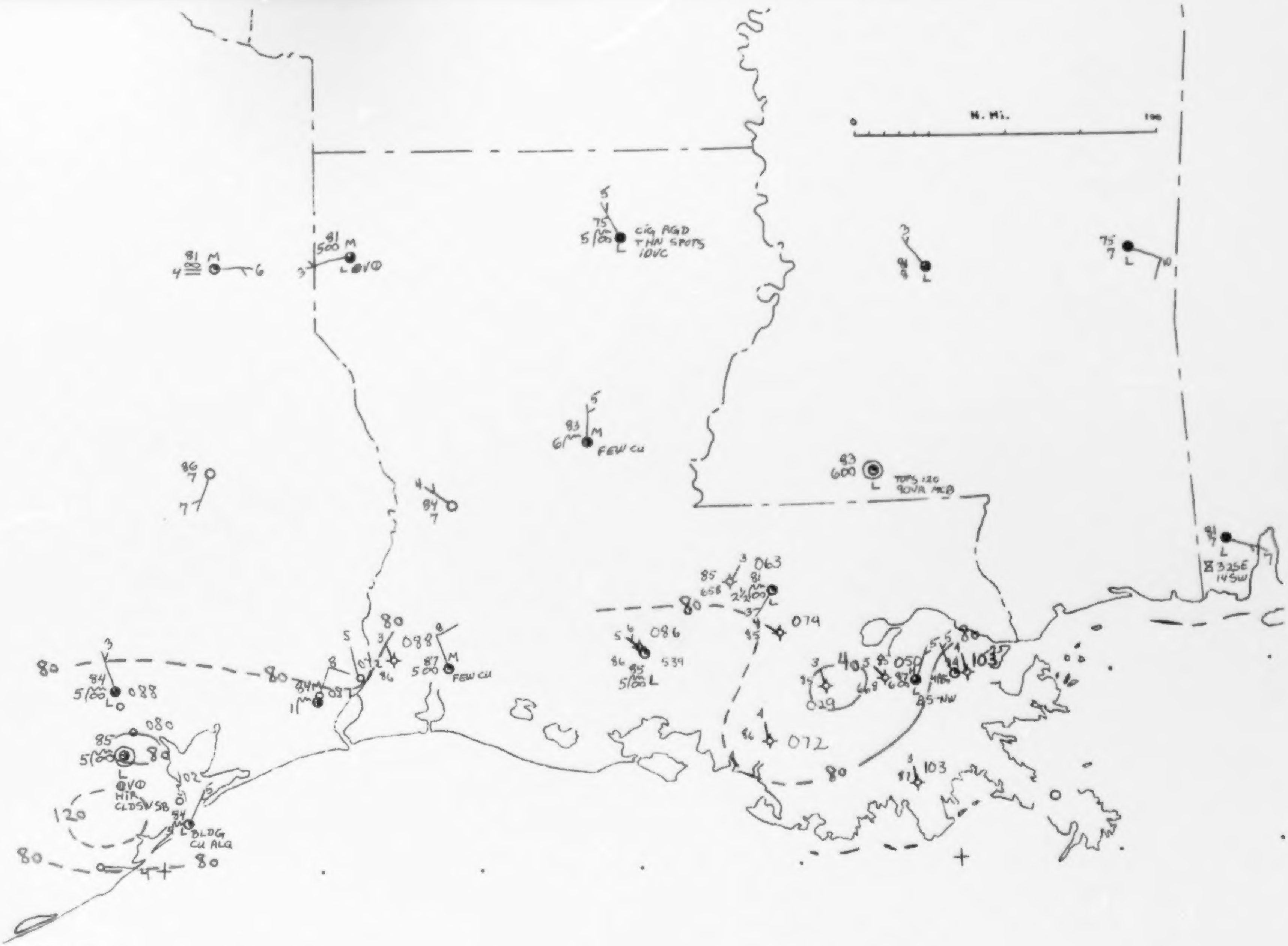
040
069
FEW CU

SURFACE OZONE AND WEATHER
9-8-76
10 CDT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FEW CU
TOPS 120 90VR MCB
X 325E 14SW
FEW CU
BLDG CU ALQ
HIR CLDS SW 58
80
80
80
80
80
80
80
80
120
088
087
088
086
539
063
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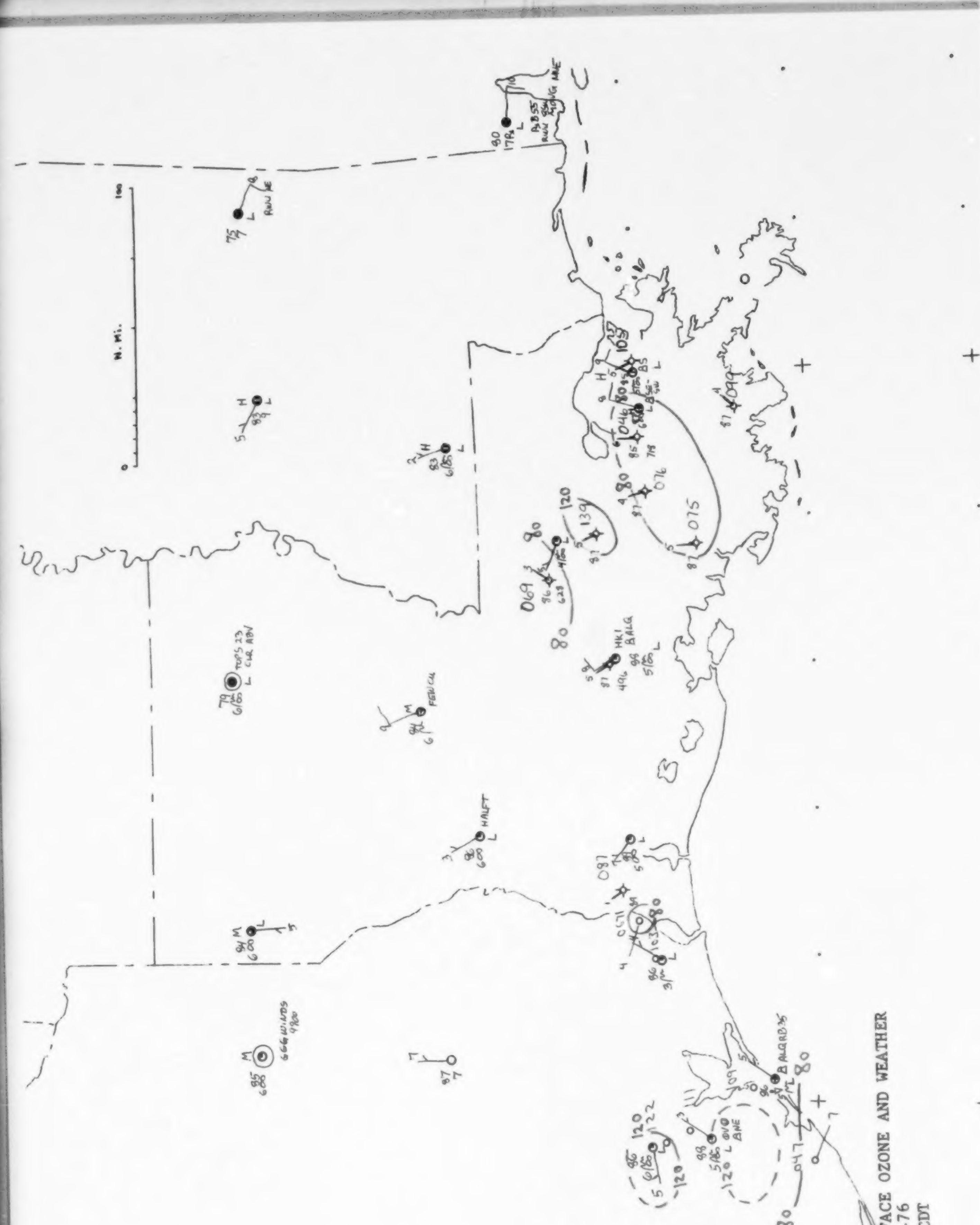
072
029
050
103
103
080
02
85 NW

9-8-76
11 CDT
SURFACE OZONE AND WEATHER



N. MI.
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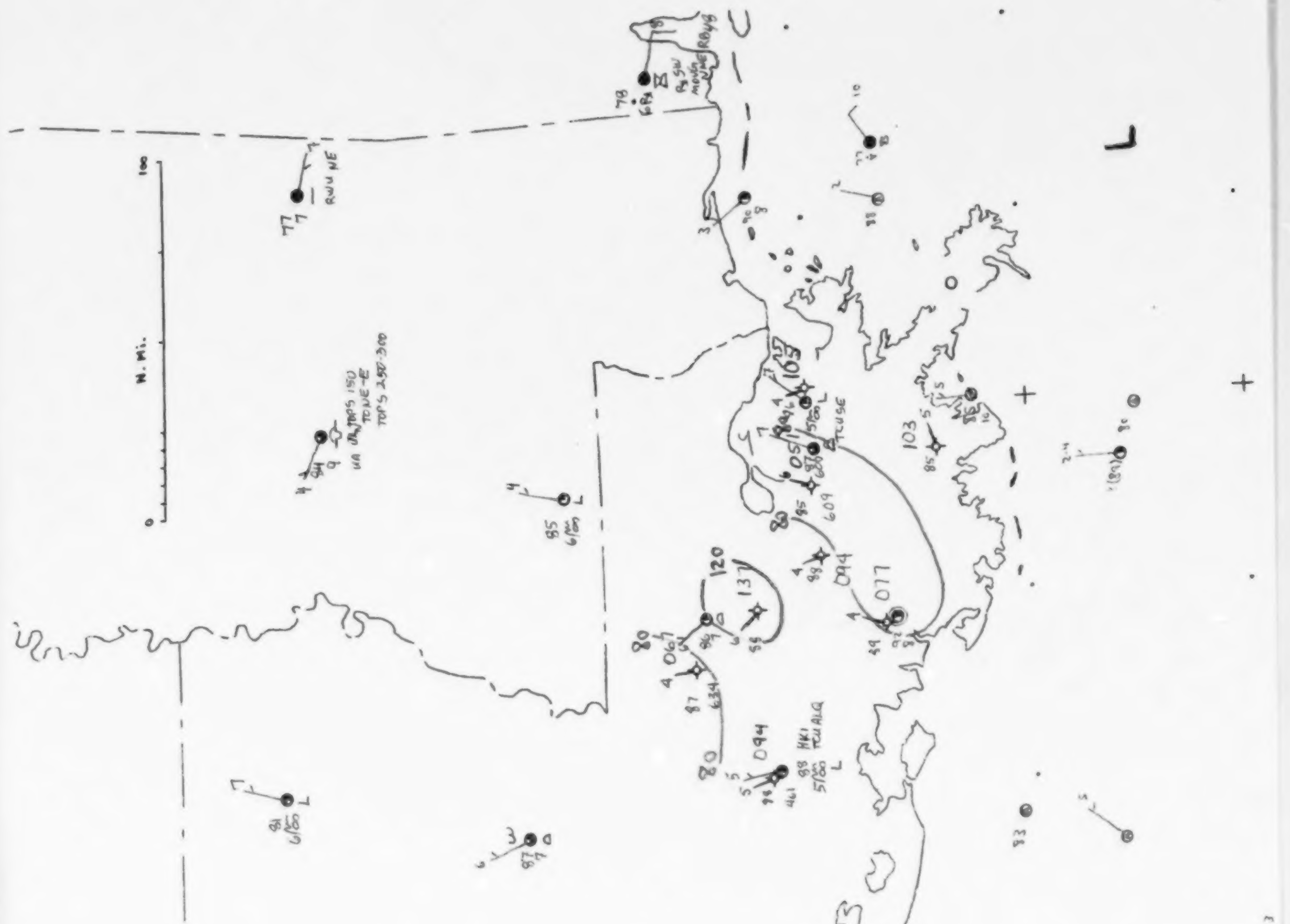
100
TOPS 23 CLR ABV
FEW CU
HALF
HK1 BALG
666 WINDS 4800
BALGRB35
RWU NE
ABSS RWU
139
120
122
103
075
076
069
081
047
80

SURFACE OZONE AND WEATHER
9-8-76
12 CDT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RWU NE
TOPS 150
TOPS 250-300
TCU ALQ
CBNW
FEW TCU ALQ
TCU ALQ
HKI TCU ALQ
TCU SE
BNG
RENT
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051
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093
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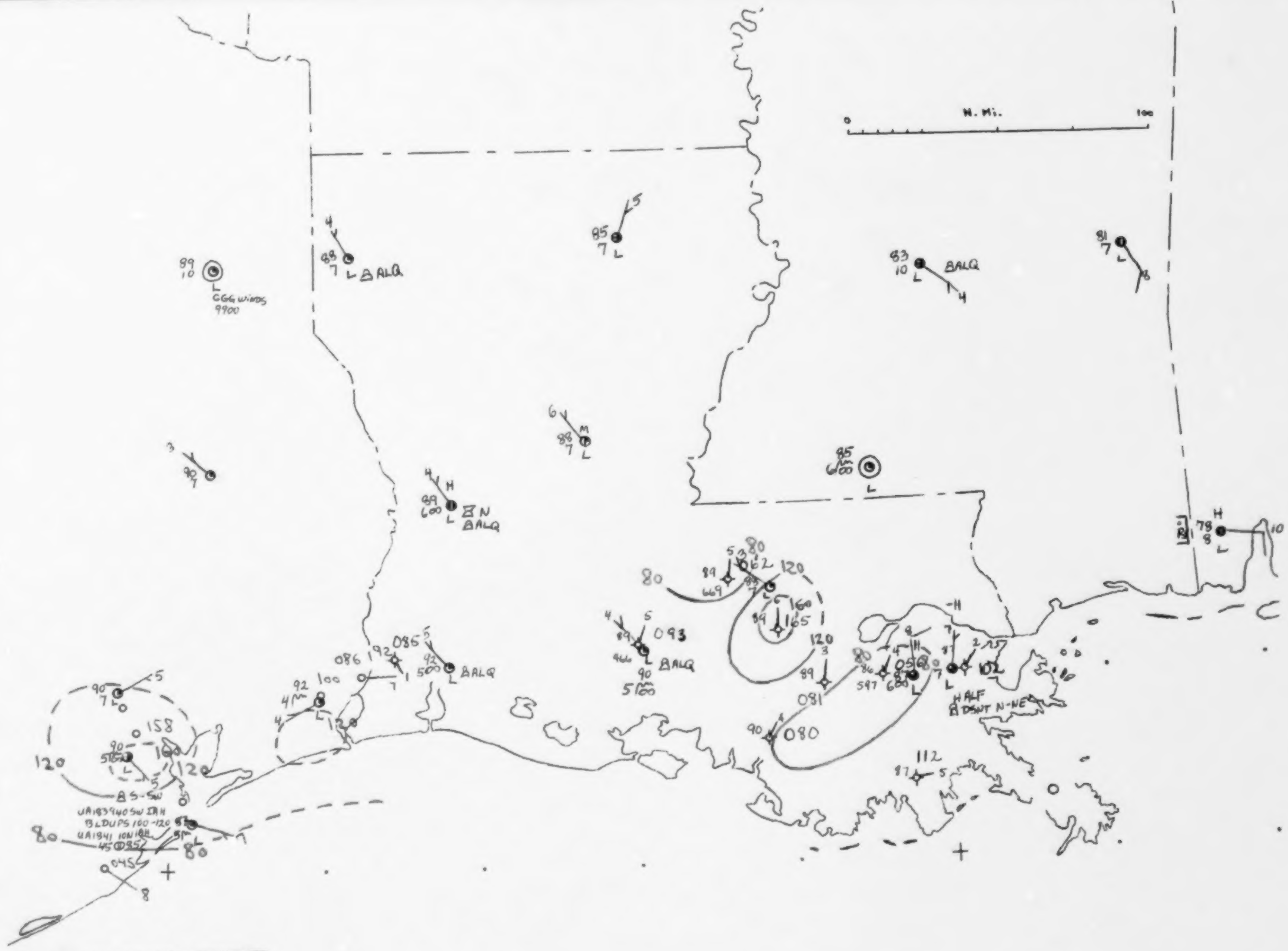
080
054

SURFACE OZONE AND WEATHER
9-8-76
13 CDT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HALF Δ DSNT N-NE
Δ S-SW
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BLDUPS 100-120
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158
160
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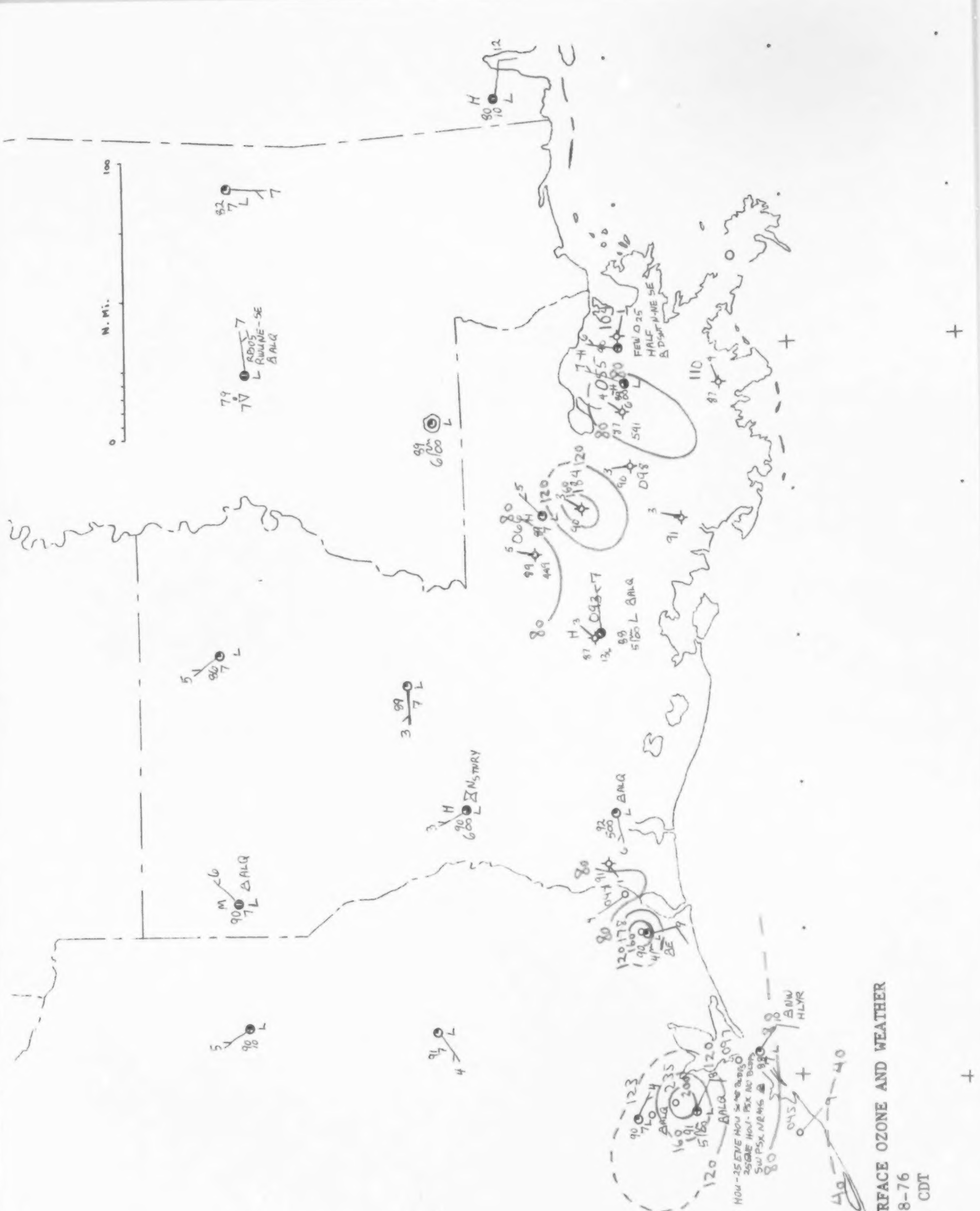
112
045

SURFACE OZONE AND WEATHER
9-8-76
14 CDT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FEW D 25
HALF
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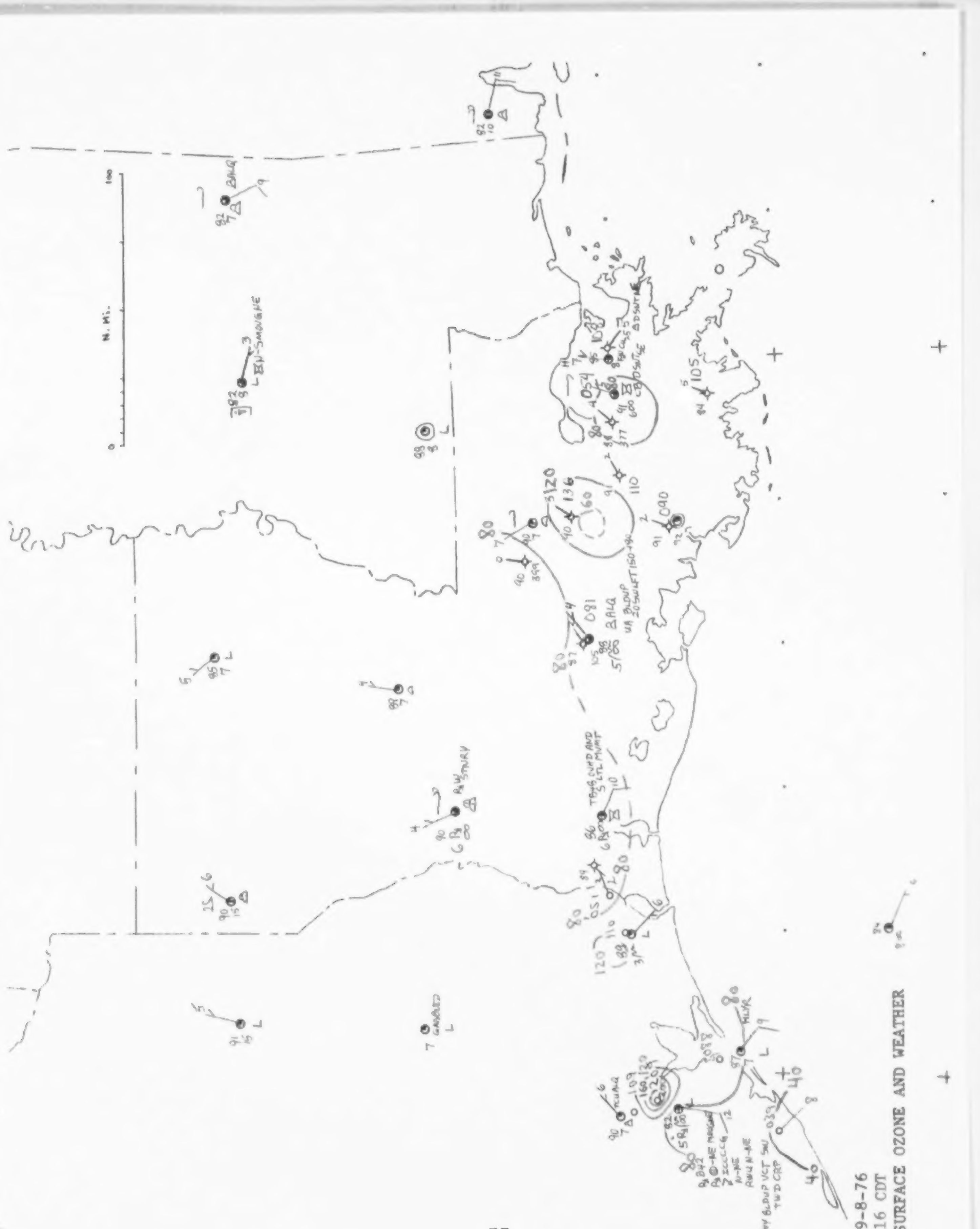
SURFACE OZONE AND WEATHER
9-8-76
15 CDT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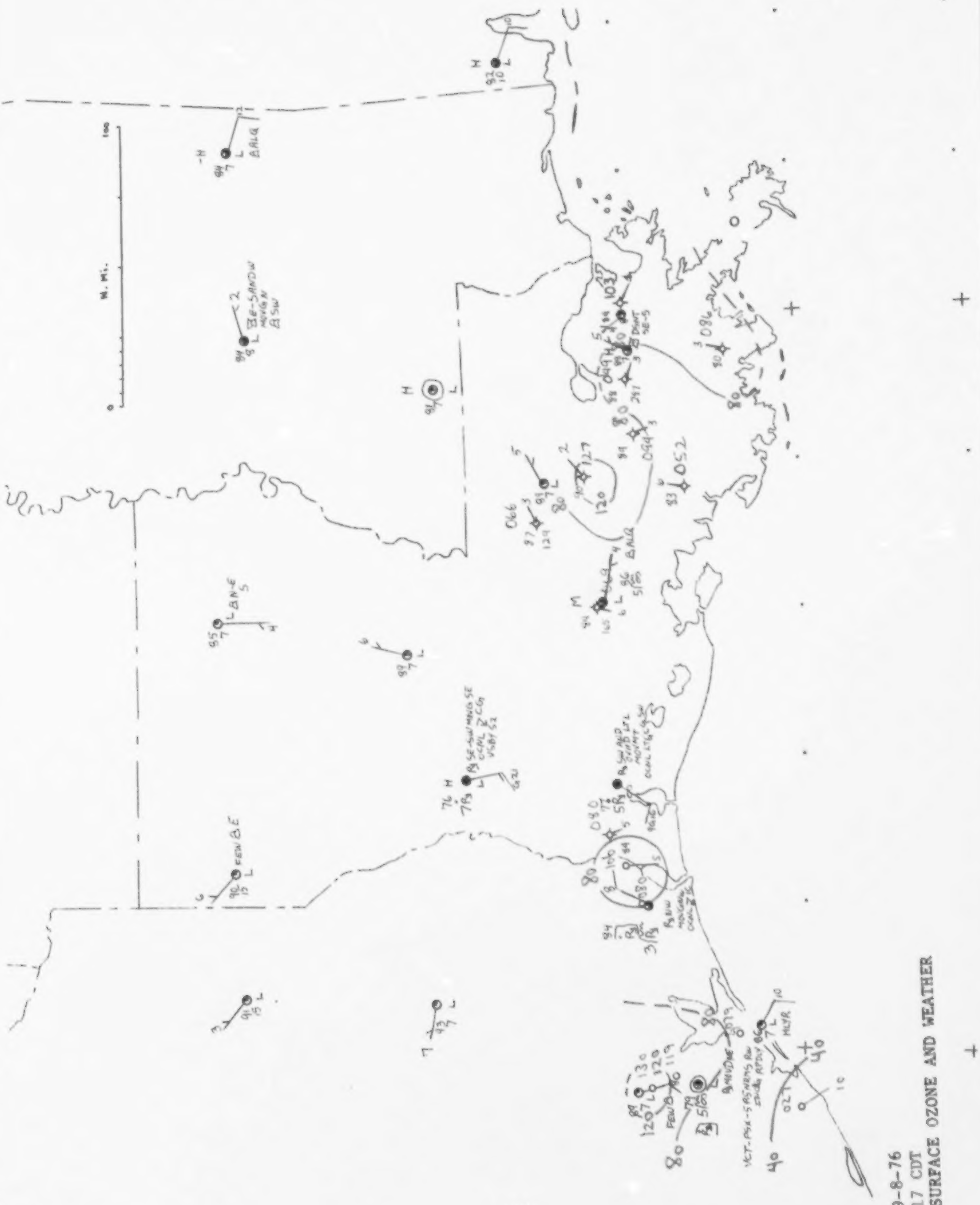
9-8-76
16 CDT
SURFACE OZONE AND WEATHER



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BE-SANDW MVG N BSW
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FEW BE
BAIR
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L
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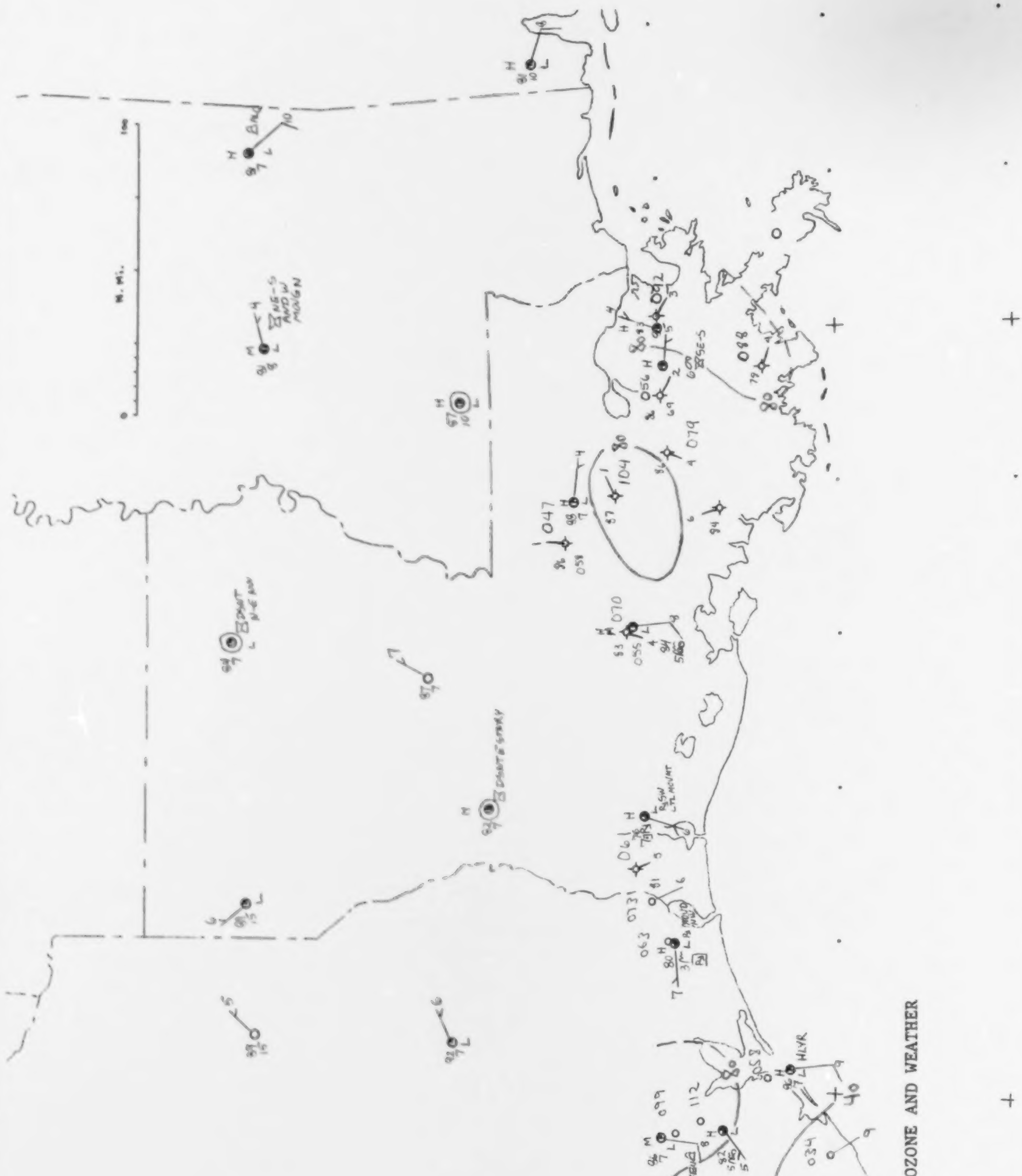
9-8-76
17 CDT
SURFACE OZONE AND WEATHER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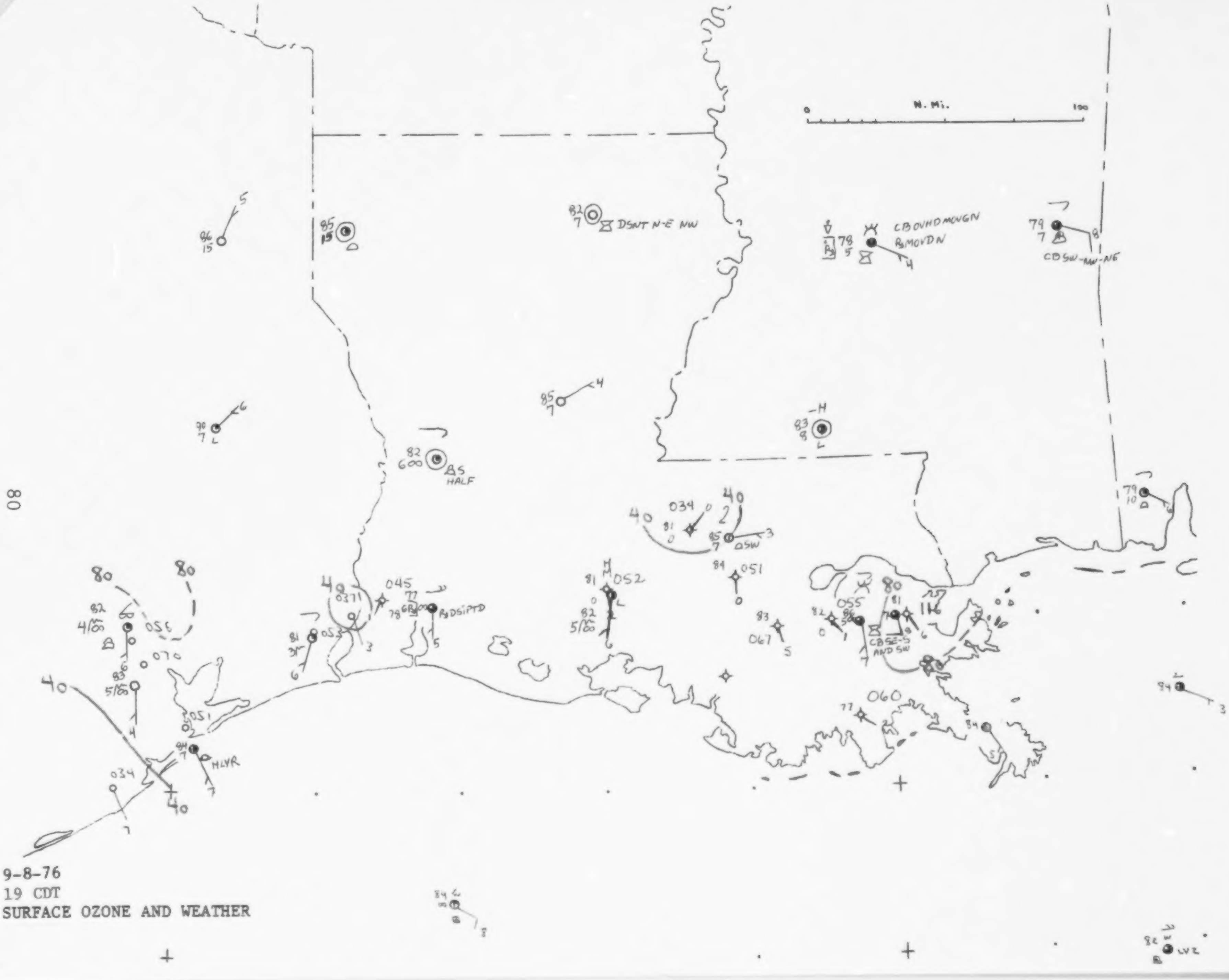
SURFACE OZONE AND WEATHER
9-8-76
18 CDT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CBOVHDMOVGN
RBMOVDN
CBSW-NW-NE
DSNT N-E NW
HALF
RBDSIPTD
DSW
CBSE-S AND SW
HLYR
LVZ
40
80
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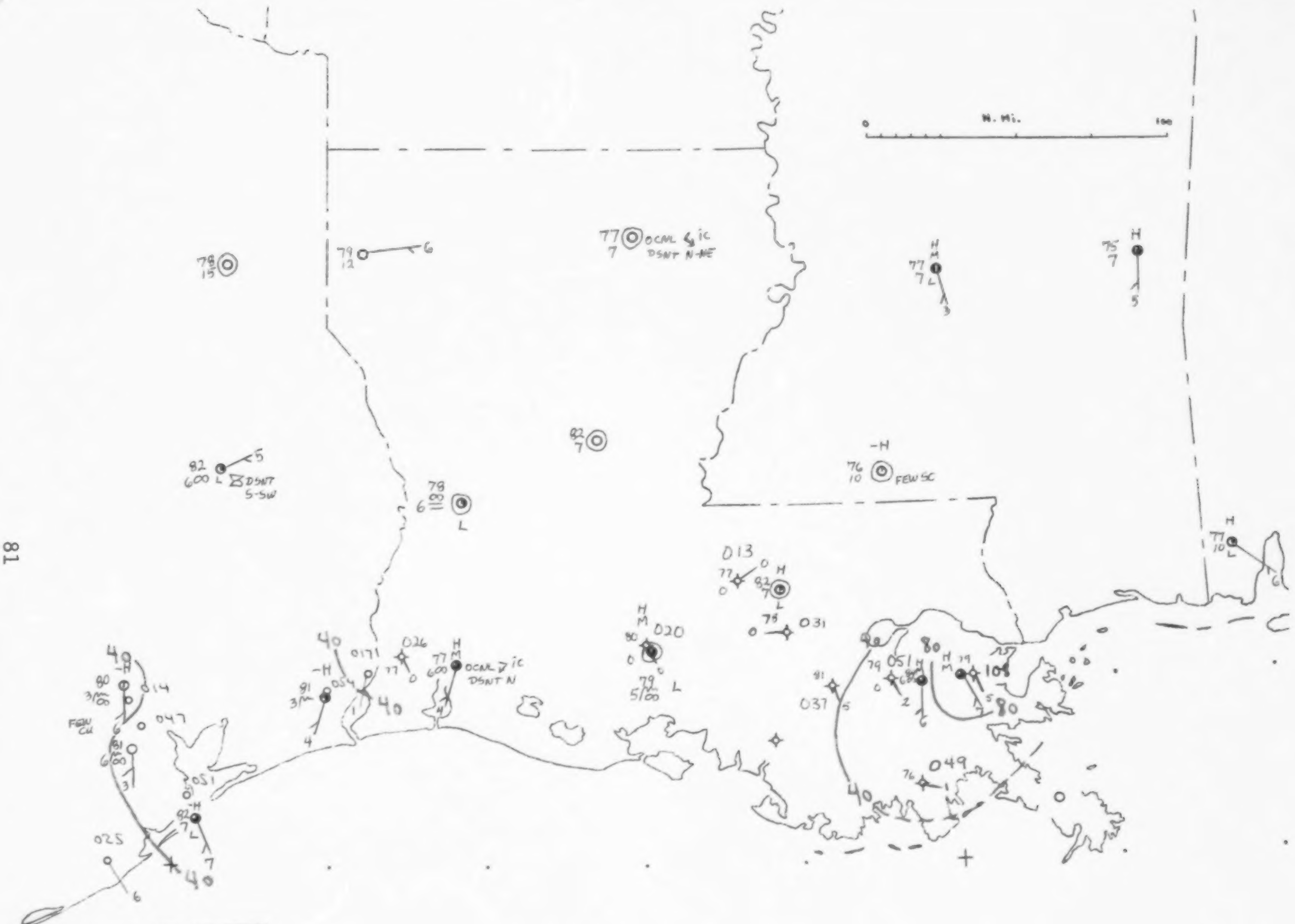
9-8-76
19 CDT
SURFACE OZONE AND WEATHER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OCNL ic DSNT N-NE
OCNL ic DSNT N
DSNT S-SW
FEW SC
FEW CU
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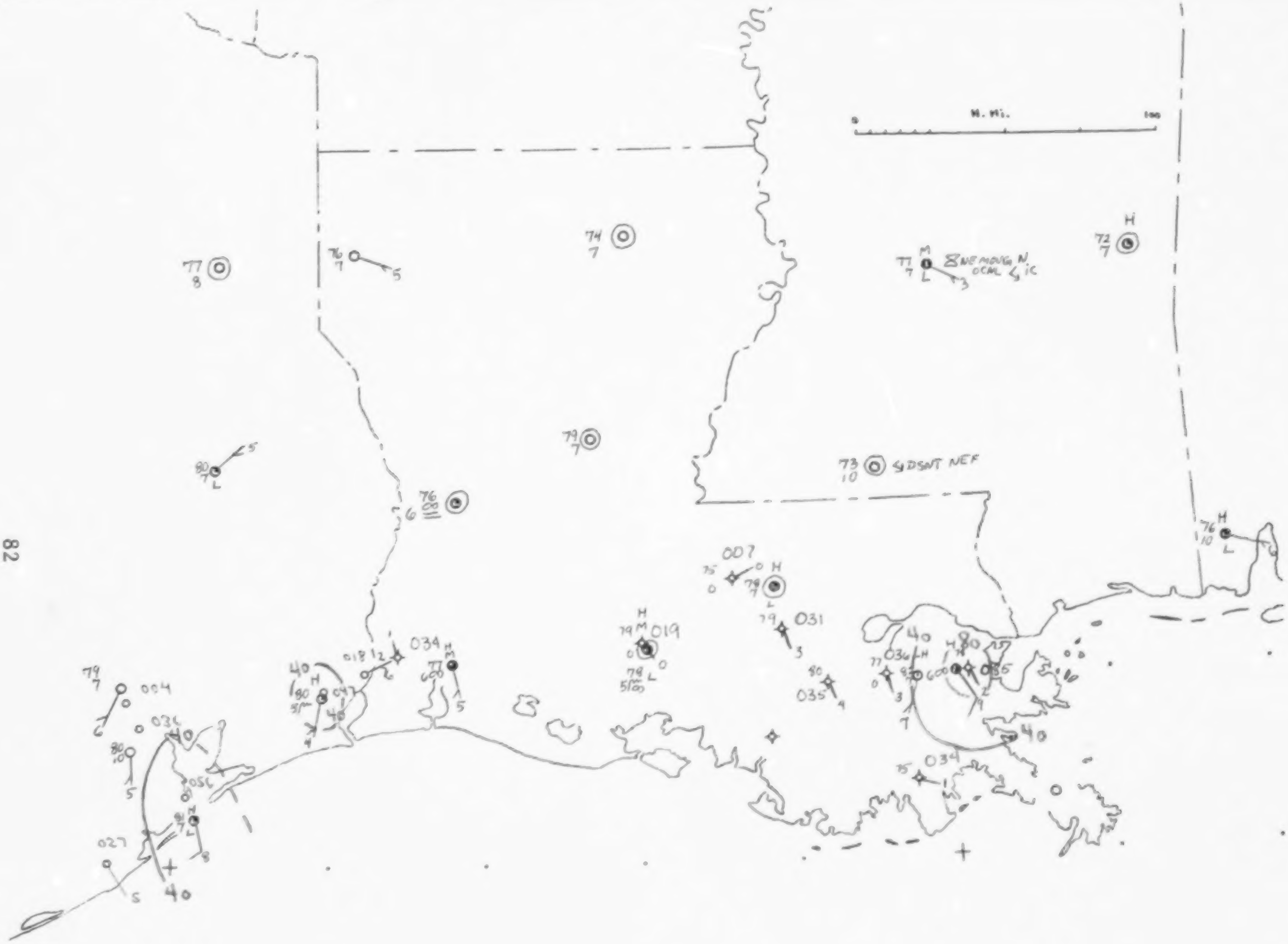
SURFACE OZONE AND WEATHER
9-8-76
20 CDT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SIDSNT NEF
034
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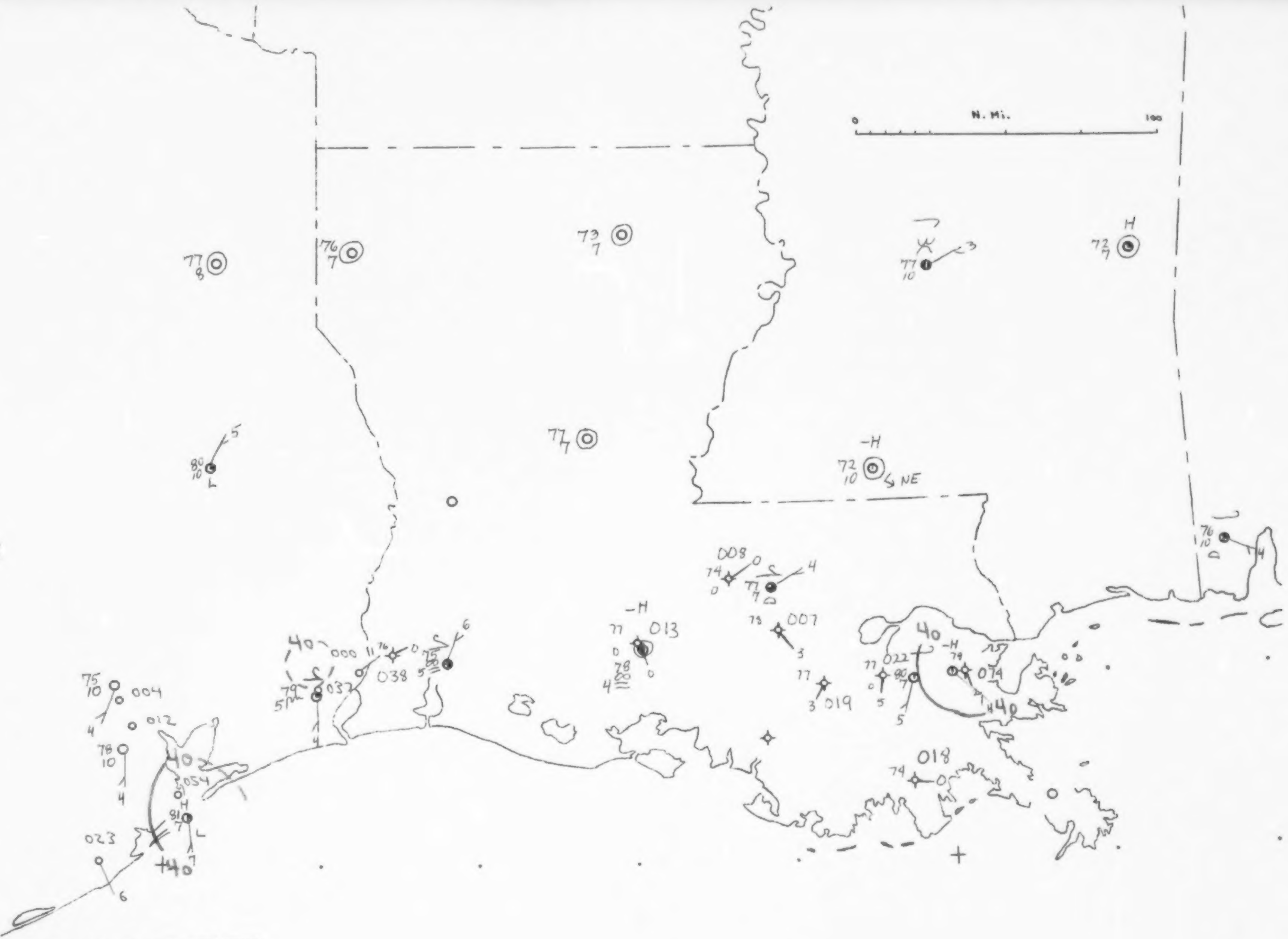
M

9-8-76
21 CDT
SURFACE OZONE AND WEATHER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-H
-H
-H
NE
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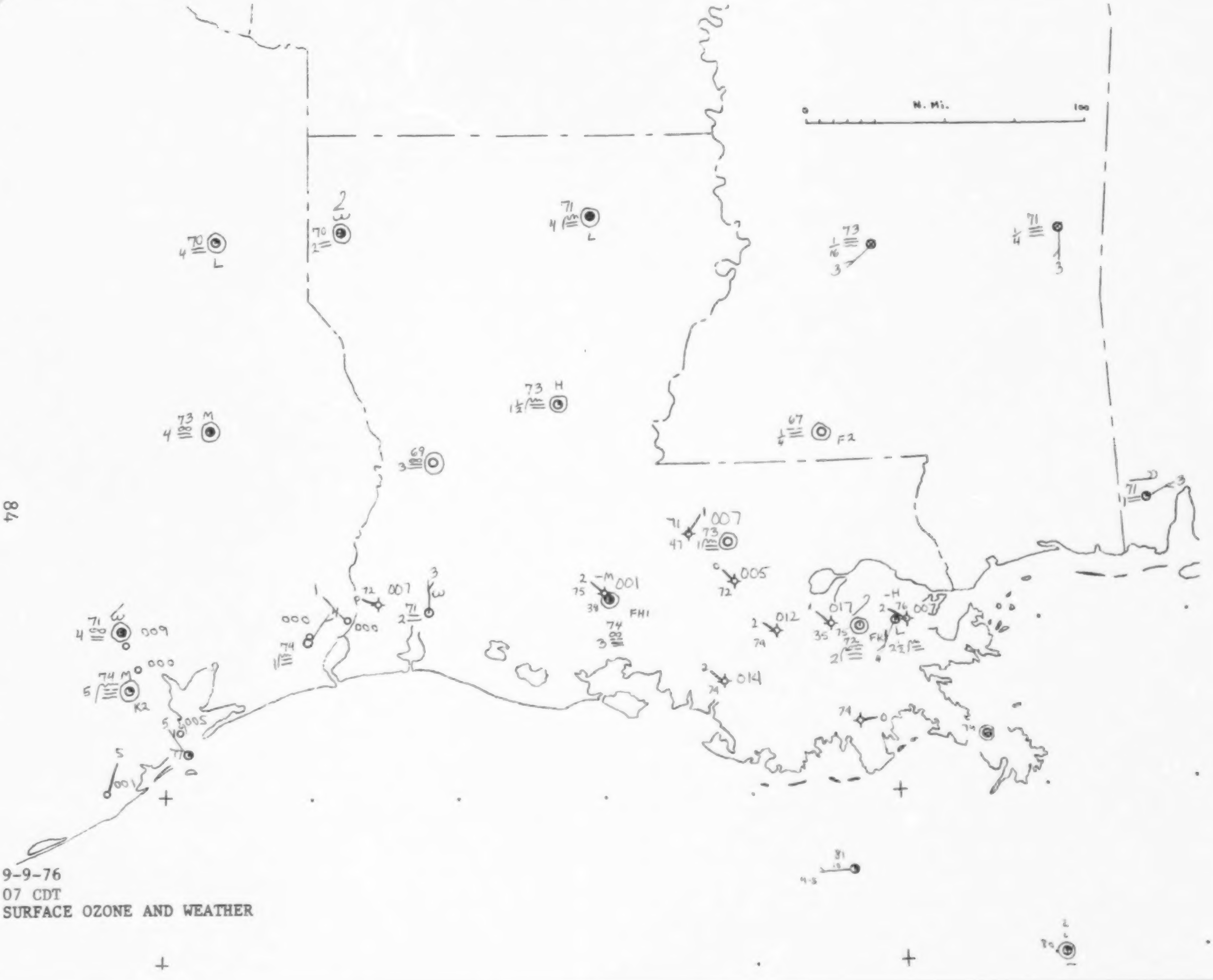
022
074
018

SURFACE OZONE AND WEATHER
9-8-76
22 CDT



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73 M
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70
71
L
73 H
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¼
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73
1/16
3
71
¼
3
007
71
47
73
005
72
001
75
39
FH1
74
012
017
35
75
72
FK
76
007
-H
L
014
74
0
71
3
007
72
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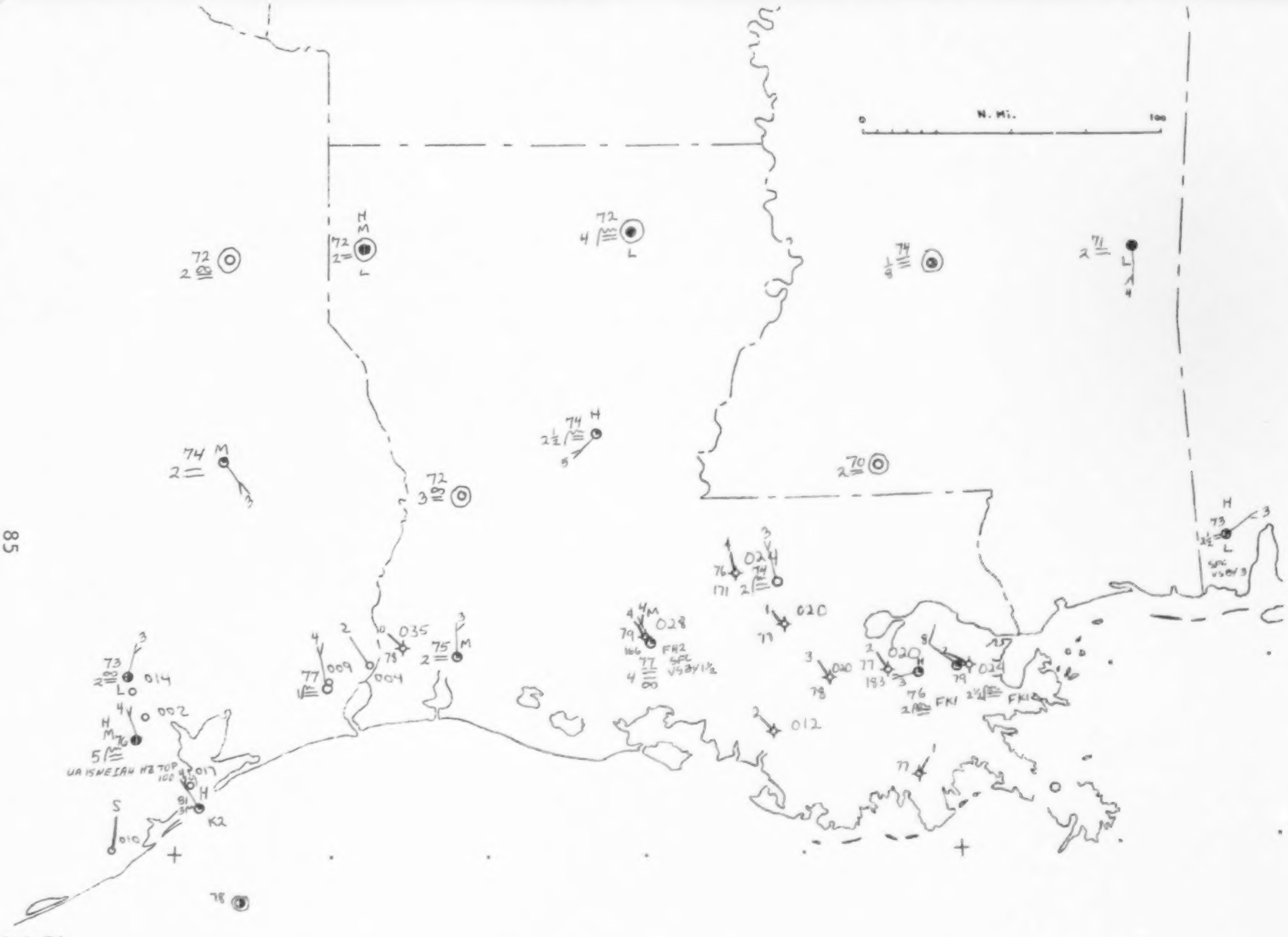
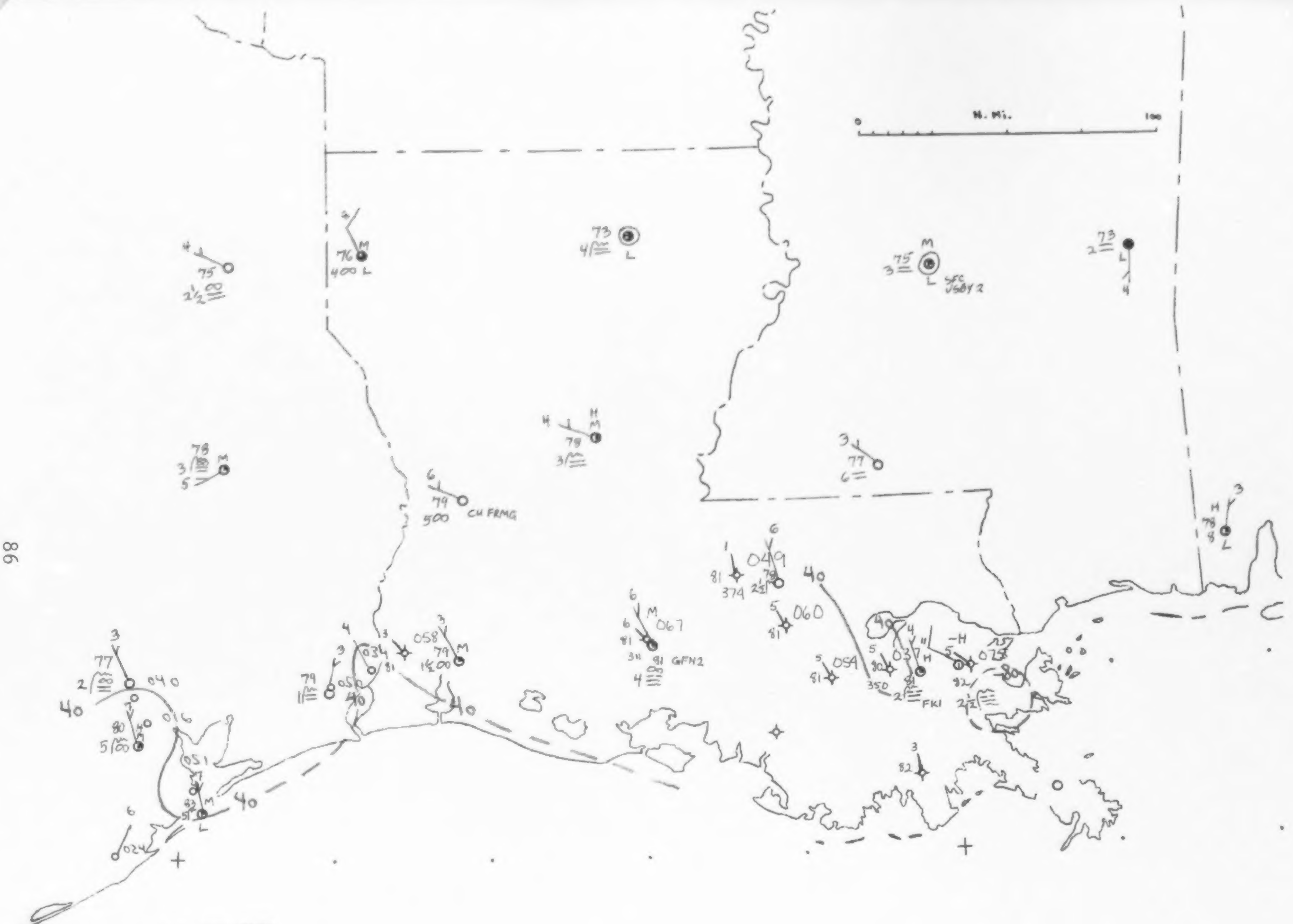
9-9-76
07 CDT
SURFACE OZONE AND WEATHER



9-9-76
08 CDT
SURFACE OZONE AND WEATHER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40
040
016
051
024
034
050
058
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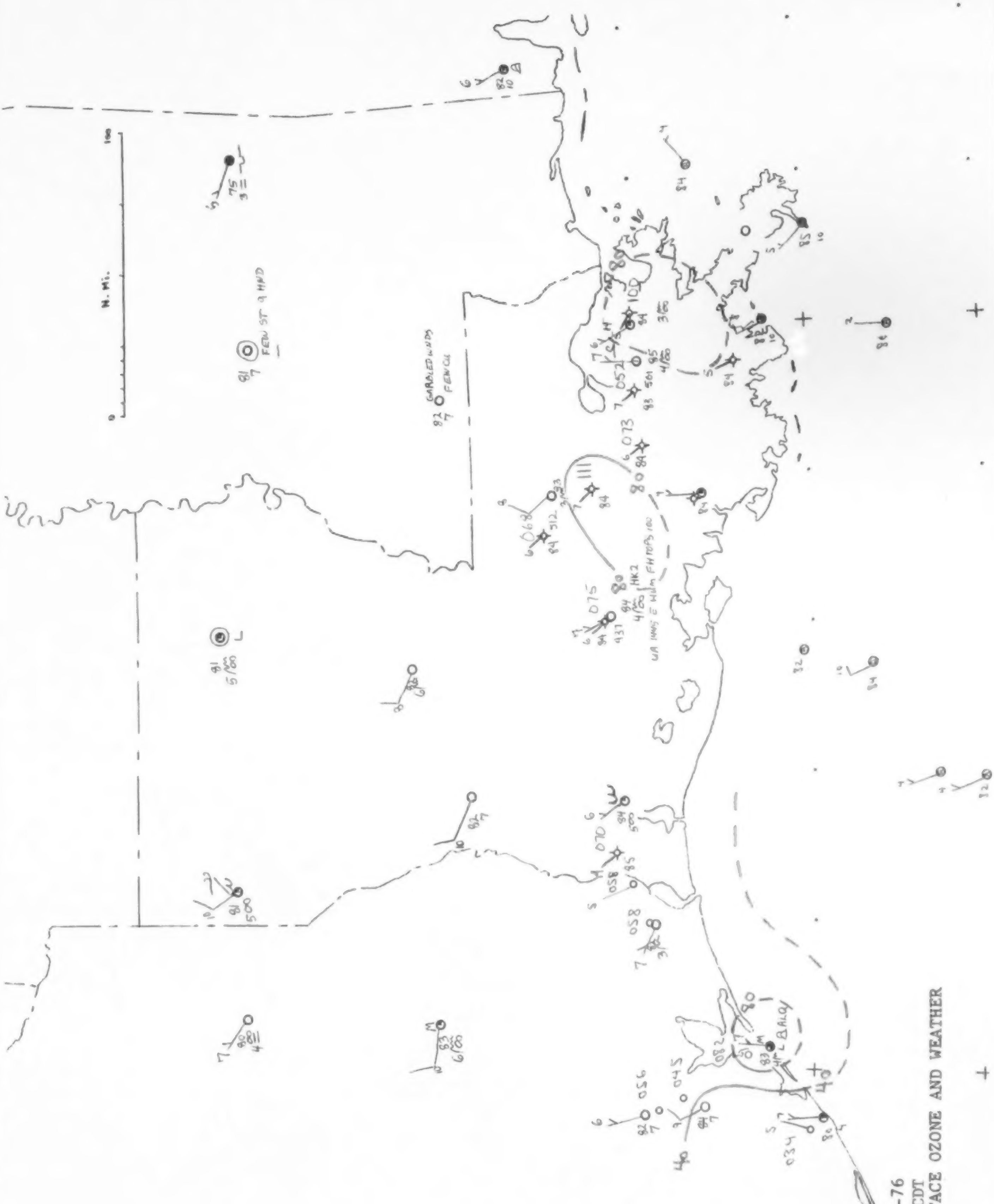
GFN2
FKI
SFC VSBY 2

SURFACE OZONE AND WEATHER
9-9-76
09 CDT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FEW ST 9 HND
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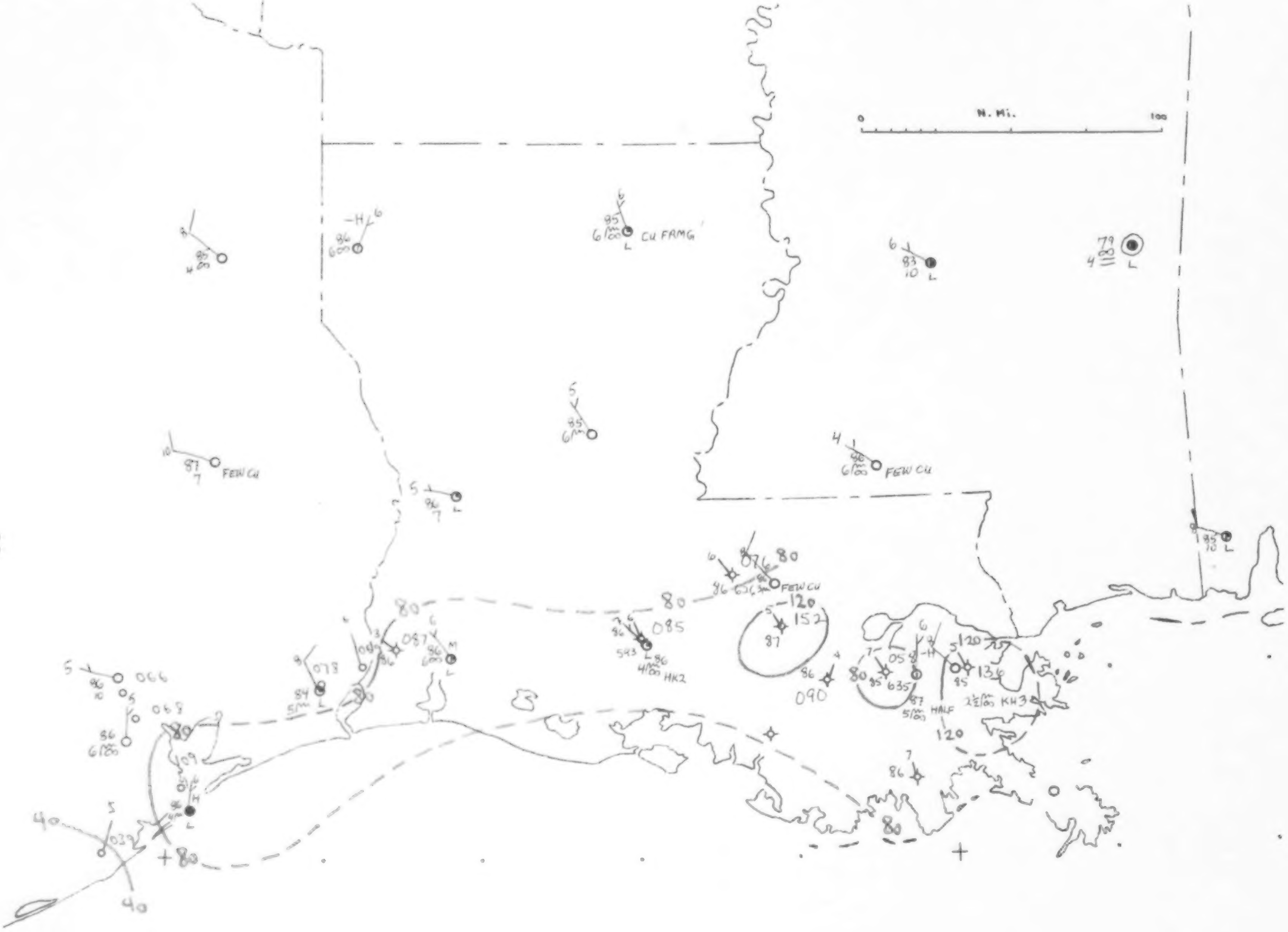
VA INNS E HWM FH TOPS 100
HK2
BALO

9-9-76
10 CDT
SURFACE OZONE AND WEATHER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CU FRMG
FEW CU
FEW CU
FEW CU
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120
152
136
085
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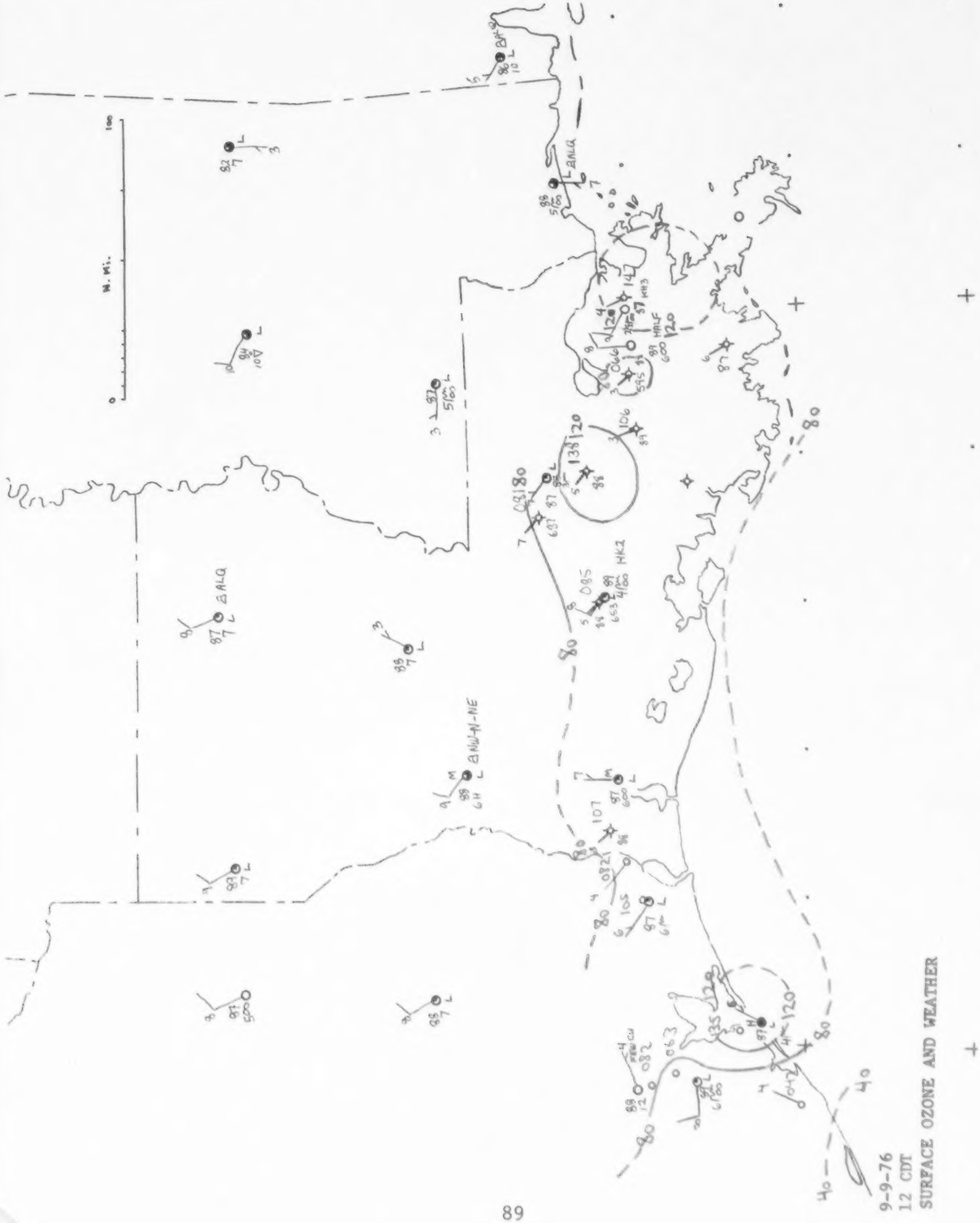
KH3
HALF

9-9-76
11 CDT
SURFACE OZONE AND WEATHER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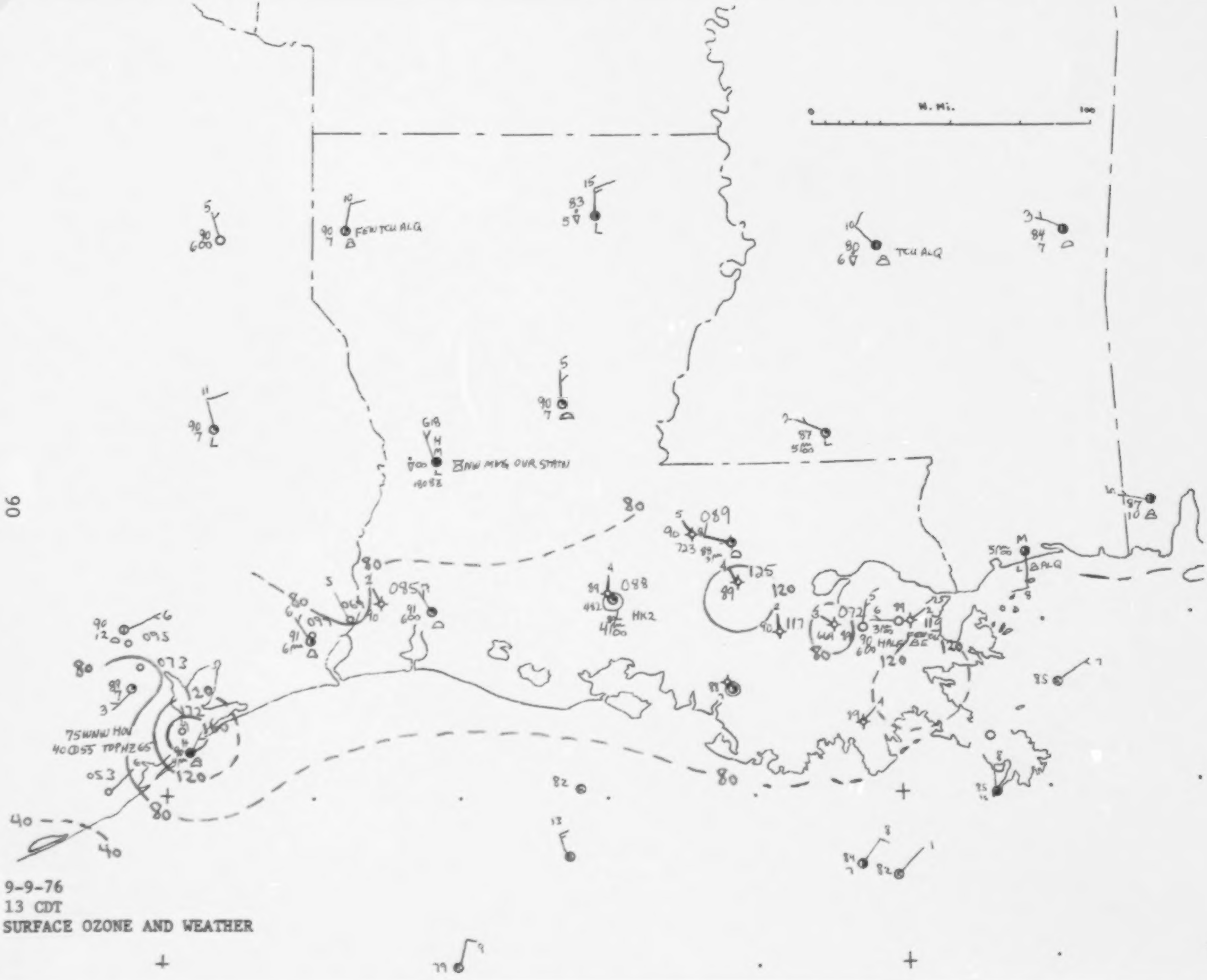
BH

9-9-76
12 CDT
SURFACE OZONE AND WEATHER



0
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FEW TCU ALQ
TCU ALQ
BNW MVG OVR STATN
BALQ
HALF BE
HK2
75WNW HOU
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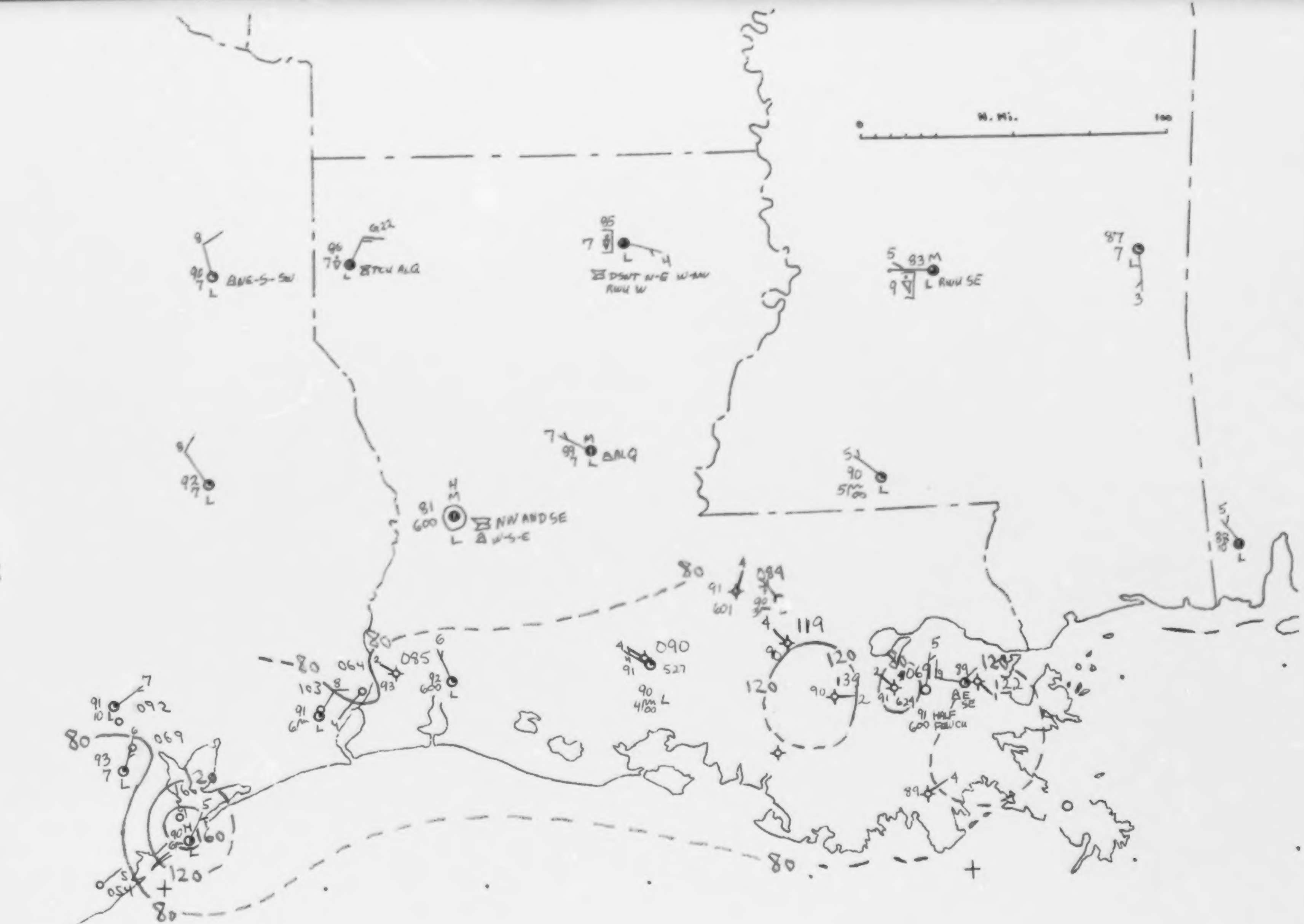
9-9-76
13 CDT
SURFACE OZONE AND WEATHER



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BTCU ALG
DSNT N-E W-NW
RWU W
RWU SE
BNLG
NW AND SE
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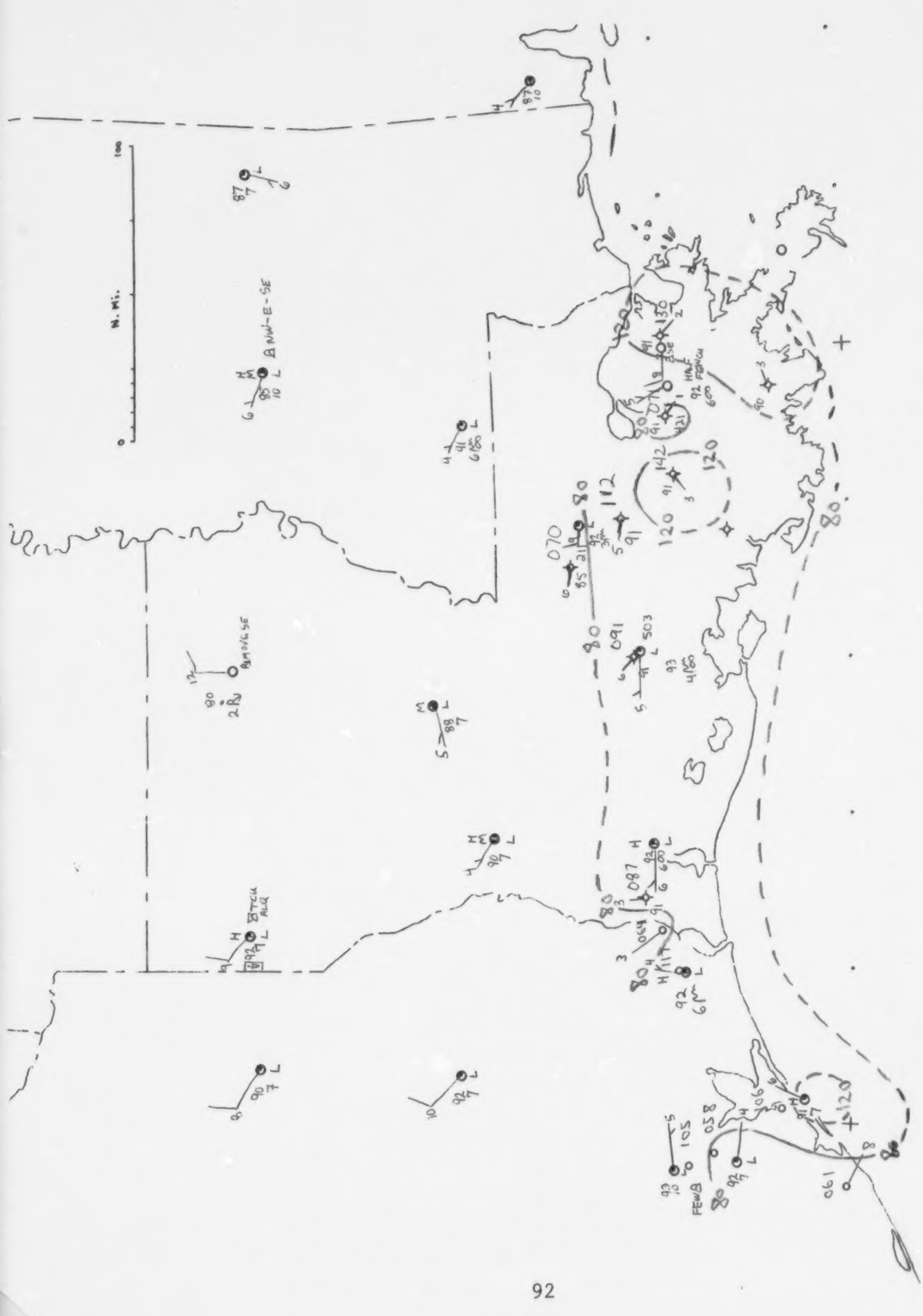
9-9-76
14 CDT
SURFACE OZONE AND WEATHER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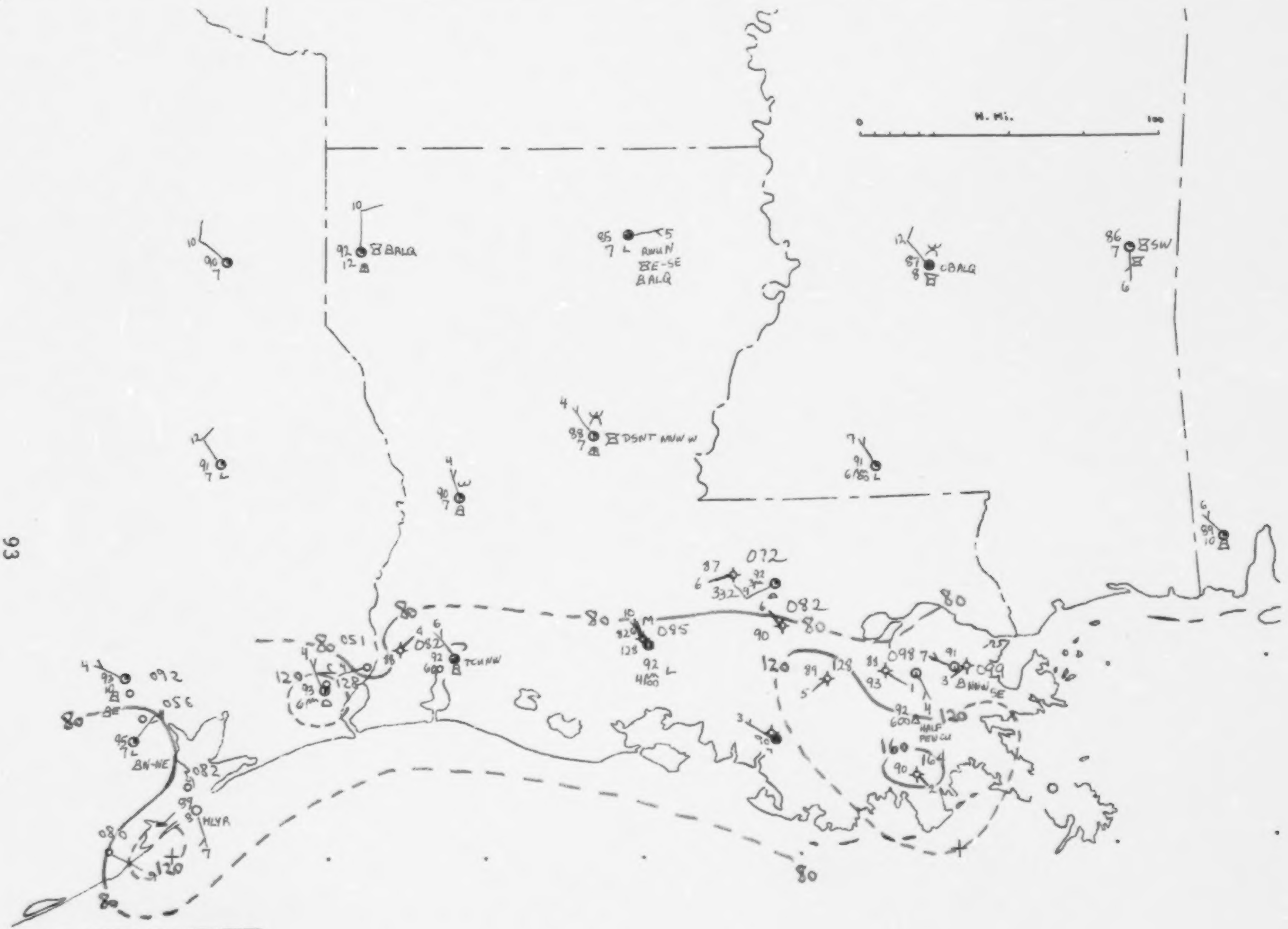
SURFACE OZONE AND WEATHER
9-9-76
15 CDT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BALQ
CBALQ
SW
DSNT NNW W
TCUNW
BNWNSE
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PEVCU
BN-NE
MLYR
092
056
082
051
082
085
072
082
098
099
128
128
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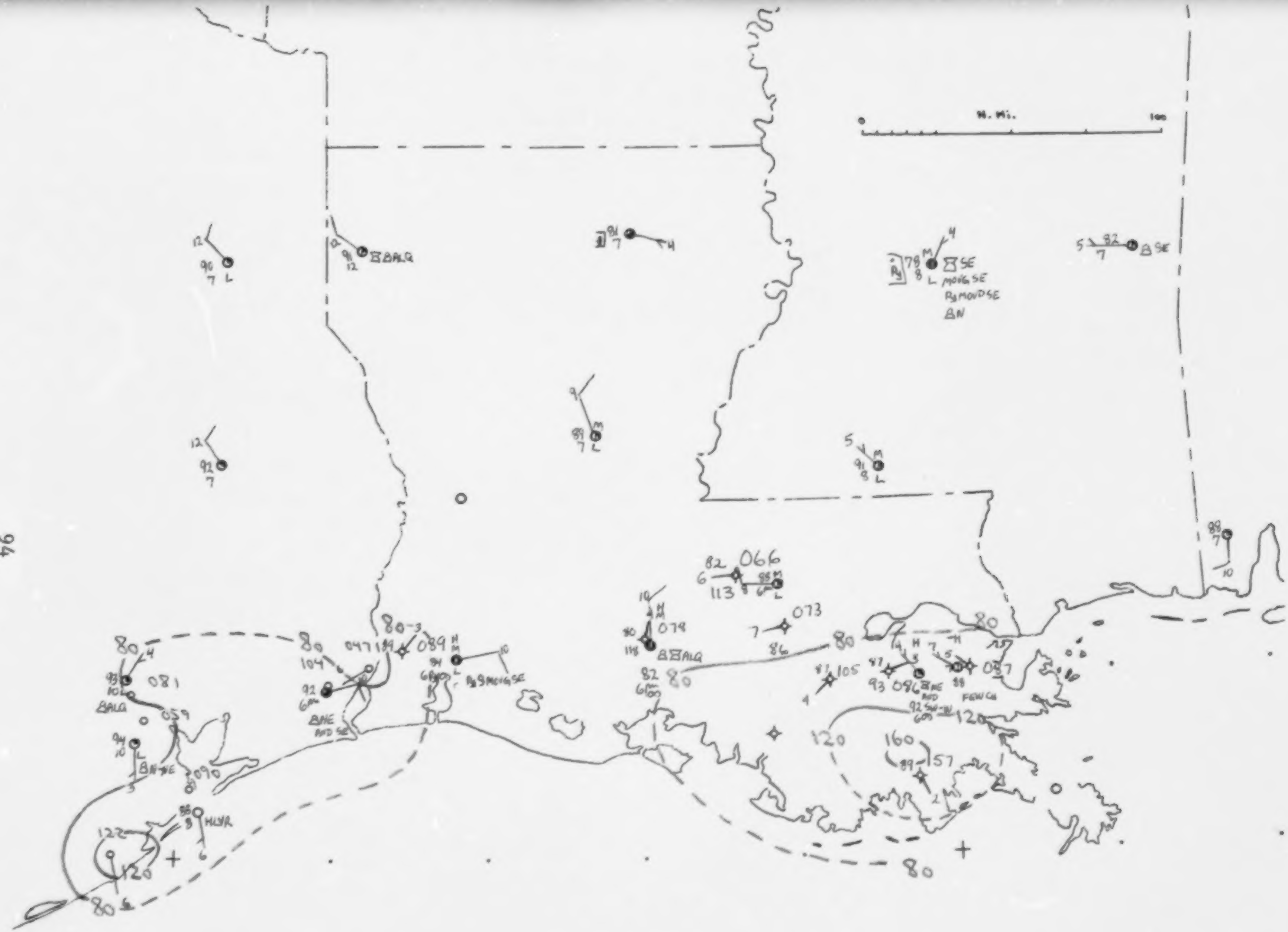
SURFACE OZONE AND WEATHER
9-9-76
16 CDT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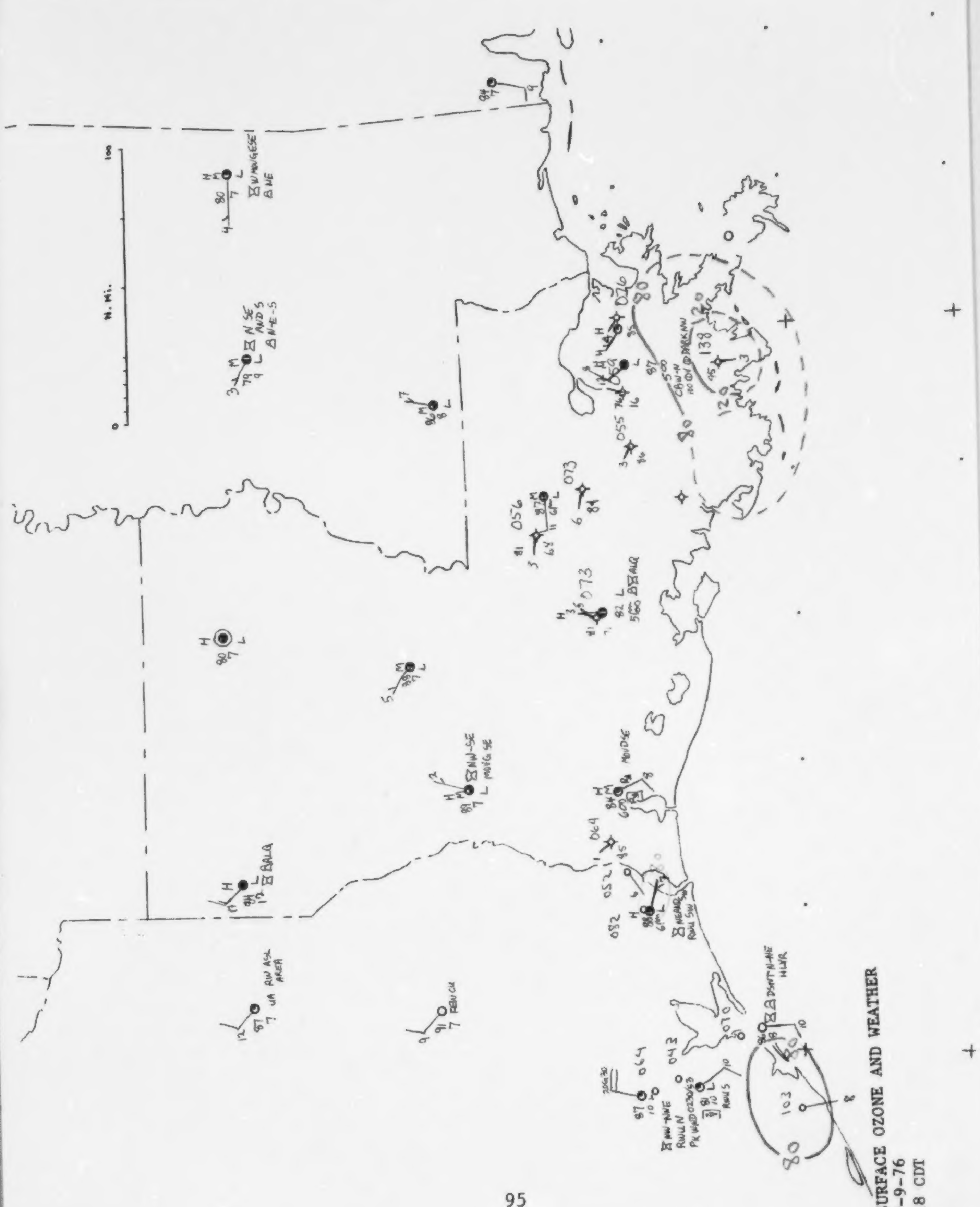
9-9-76
17 CDT
SURFACE OZONE AND WEATHER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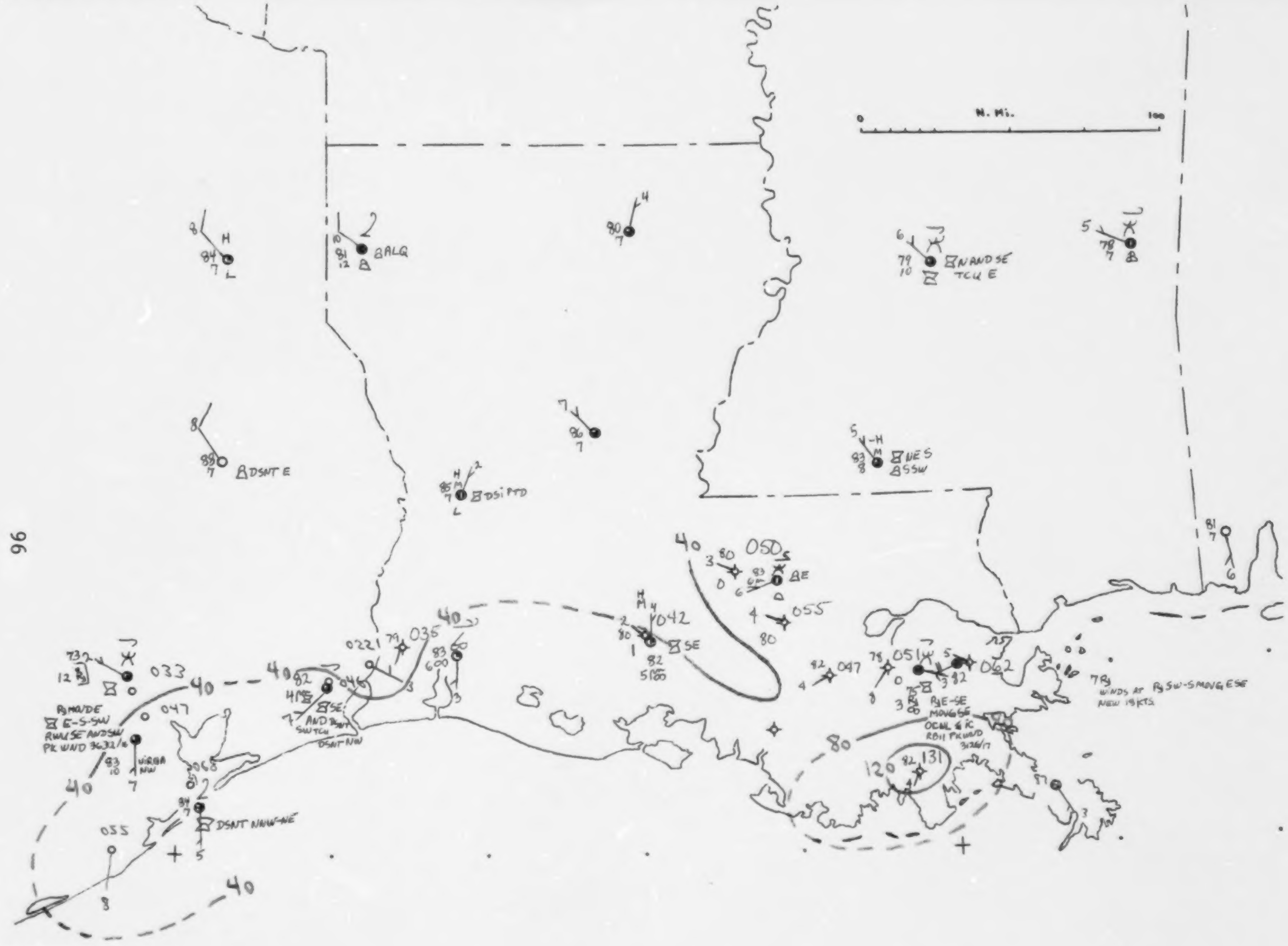
SURFACE OZONE AND WEATHER
9-9-76
18 CDT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BDSNT E
BDSIPTD
NANDSE
TCU E
NES
BSSW
BE
SE
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055
042
035
033
047
046
022
051
062
068
055
80
120
131
DSNT NNW-NE
WINDS AT BSW-SMOVG ESE
NEW 19 KTS
RAE-SE MOVG SE
OCNL & IC
RBII PK WND
BMOVDE
E-S-SW
RWUSE AND SW
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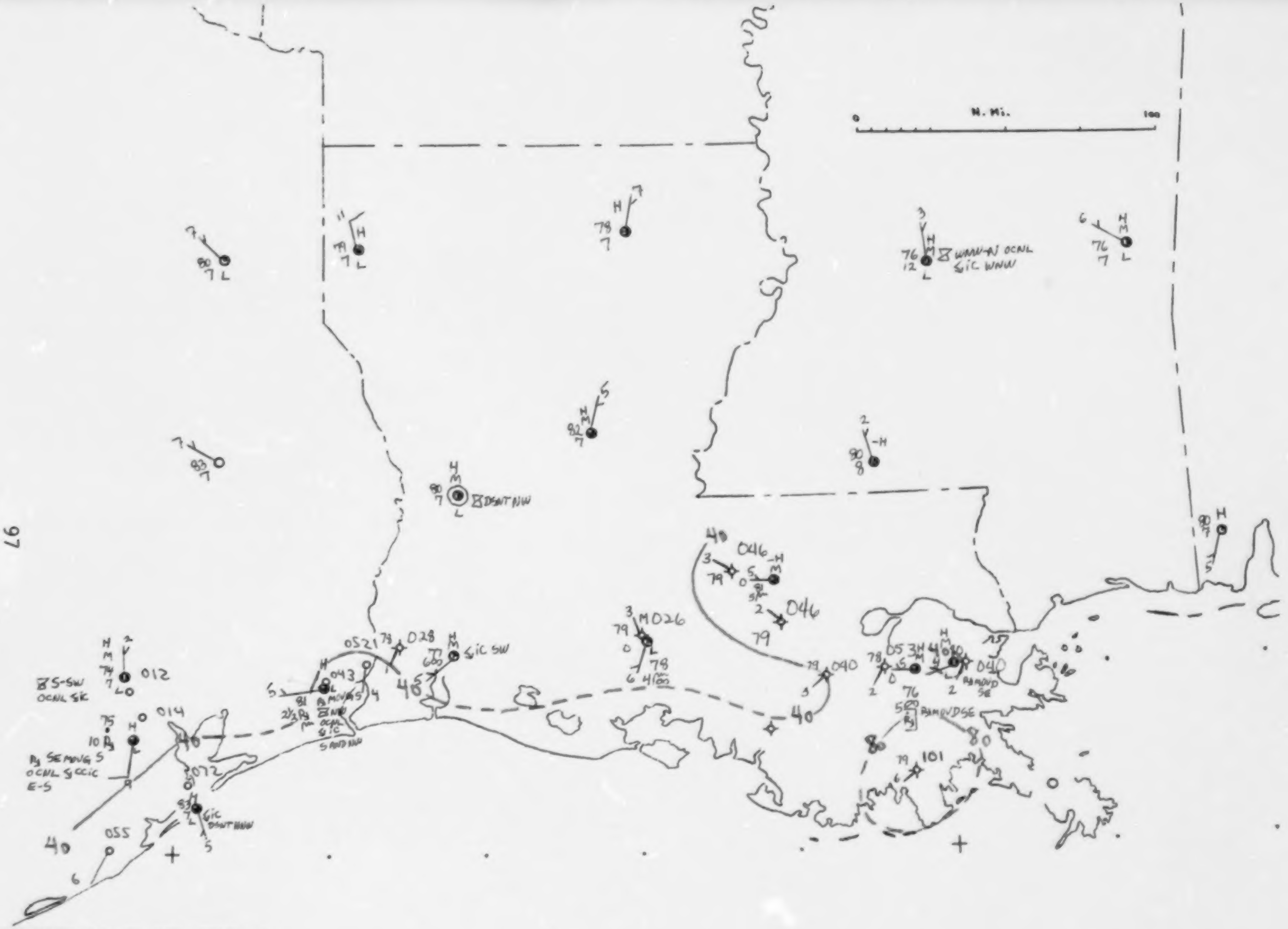
VIRGA NW
AND BSNT
SWTCU
DSNT NW

9-9-76
19 CDT
SURFACE OZONE AND WEATHER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012
014
072
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40
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40
40
80
80
ɃS-SW OCNL SIC
R̸ SE MOVG S OCNL SICCIC E-S
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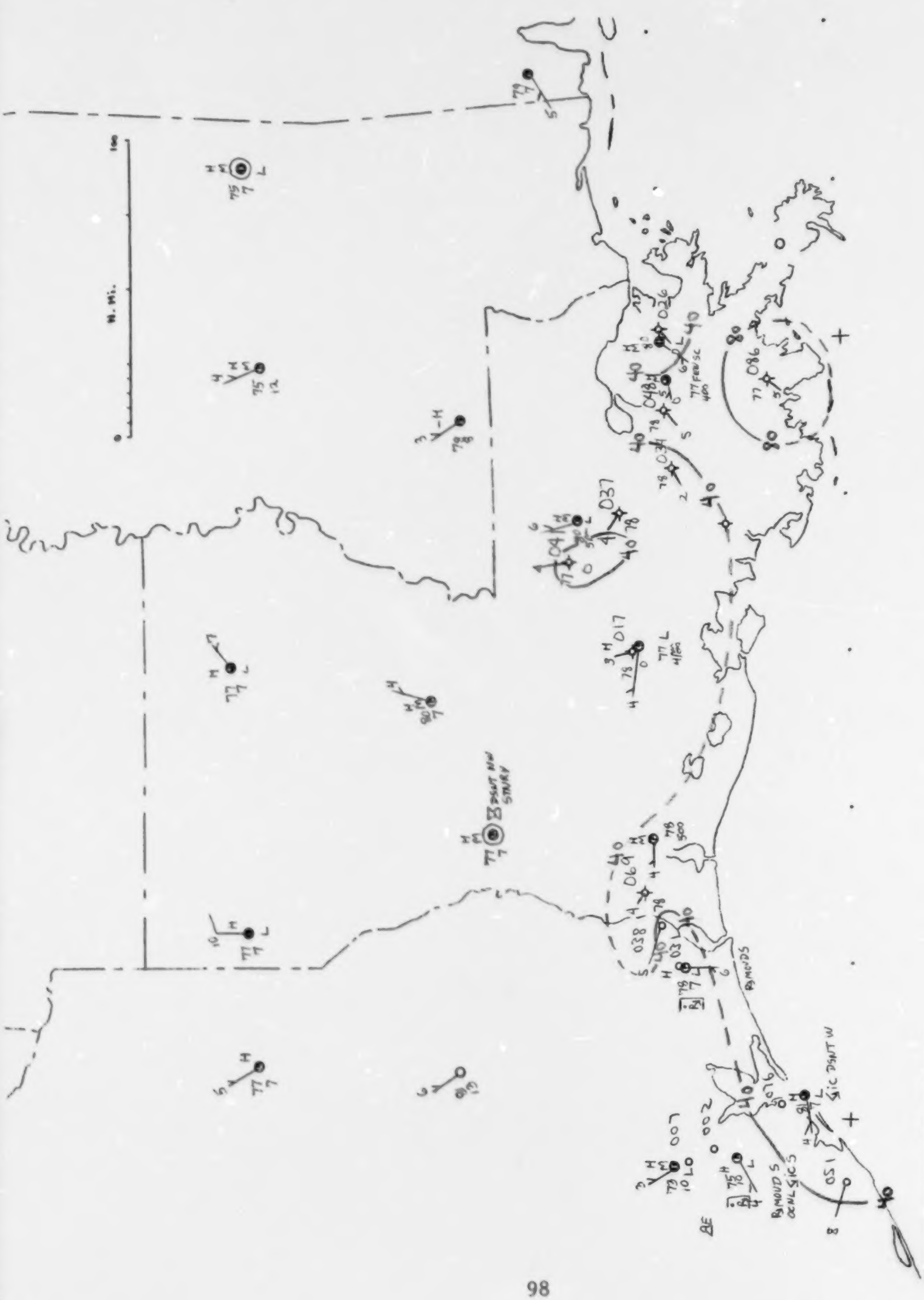
SURFACE OZONE AND WEATHER
9-9-76
20 CDT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RJMOVDS
RJMOVD S
OCNL SIC S
SIC DSNT W
BE
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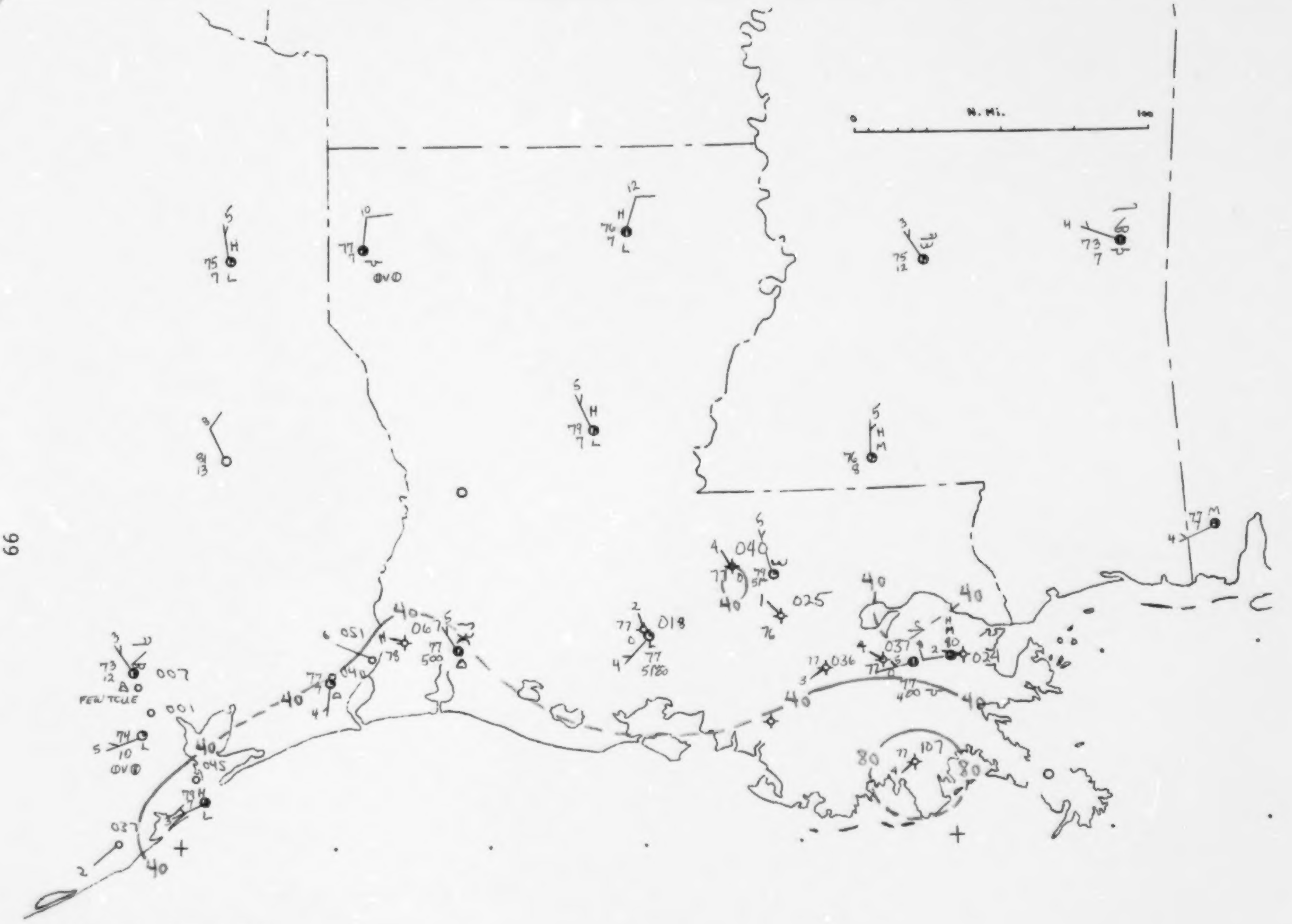
SURFACE OZONE AND WEATHER
9-9-76
21 CDT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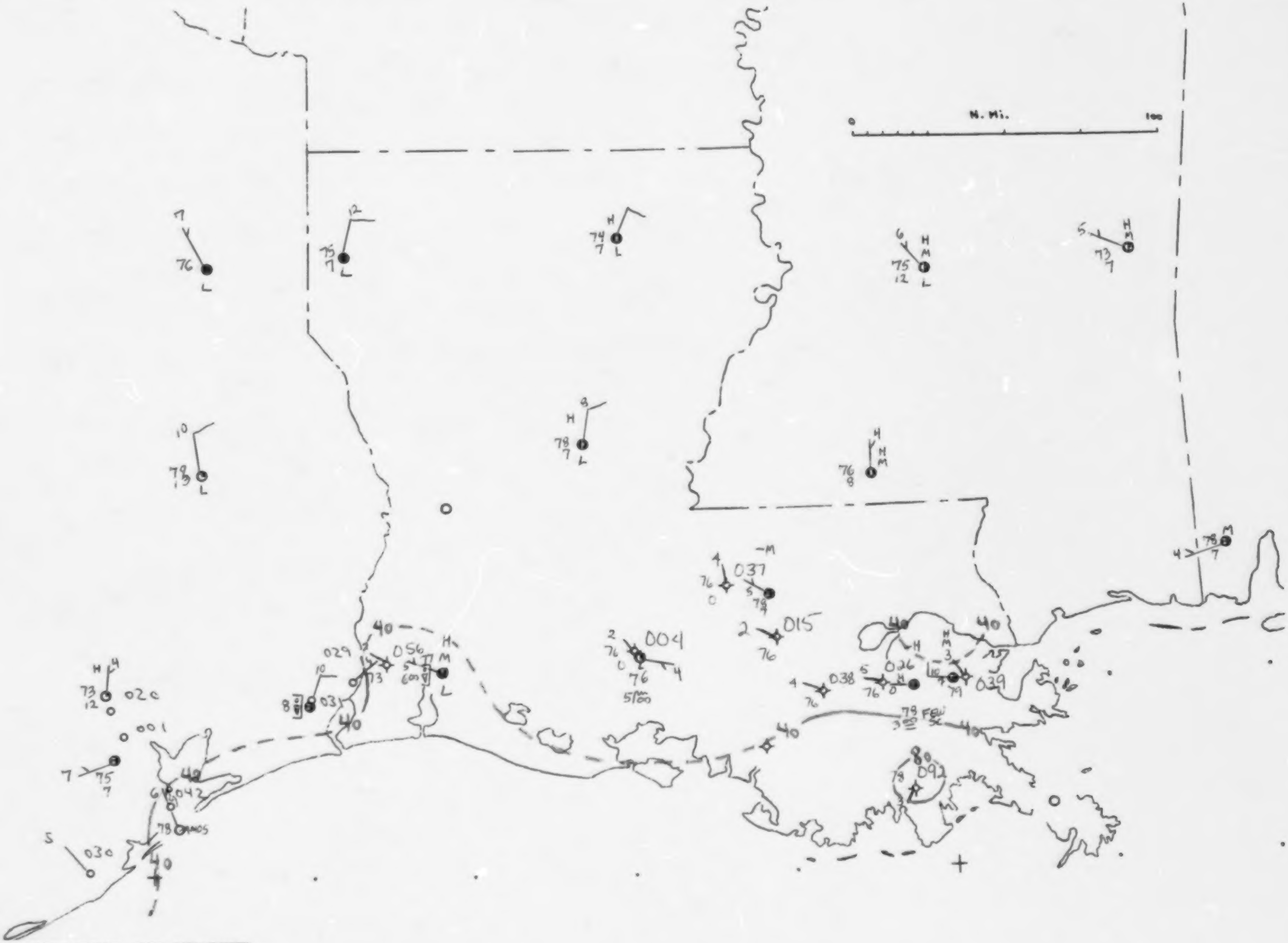
SURFACE OZONE AND WEATHER
9-9-76
22 CDT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092
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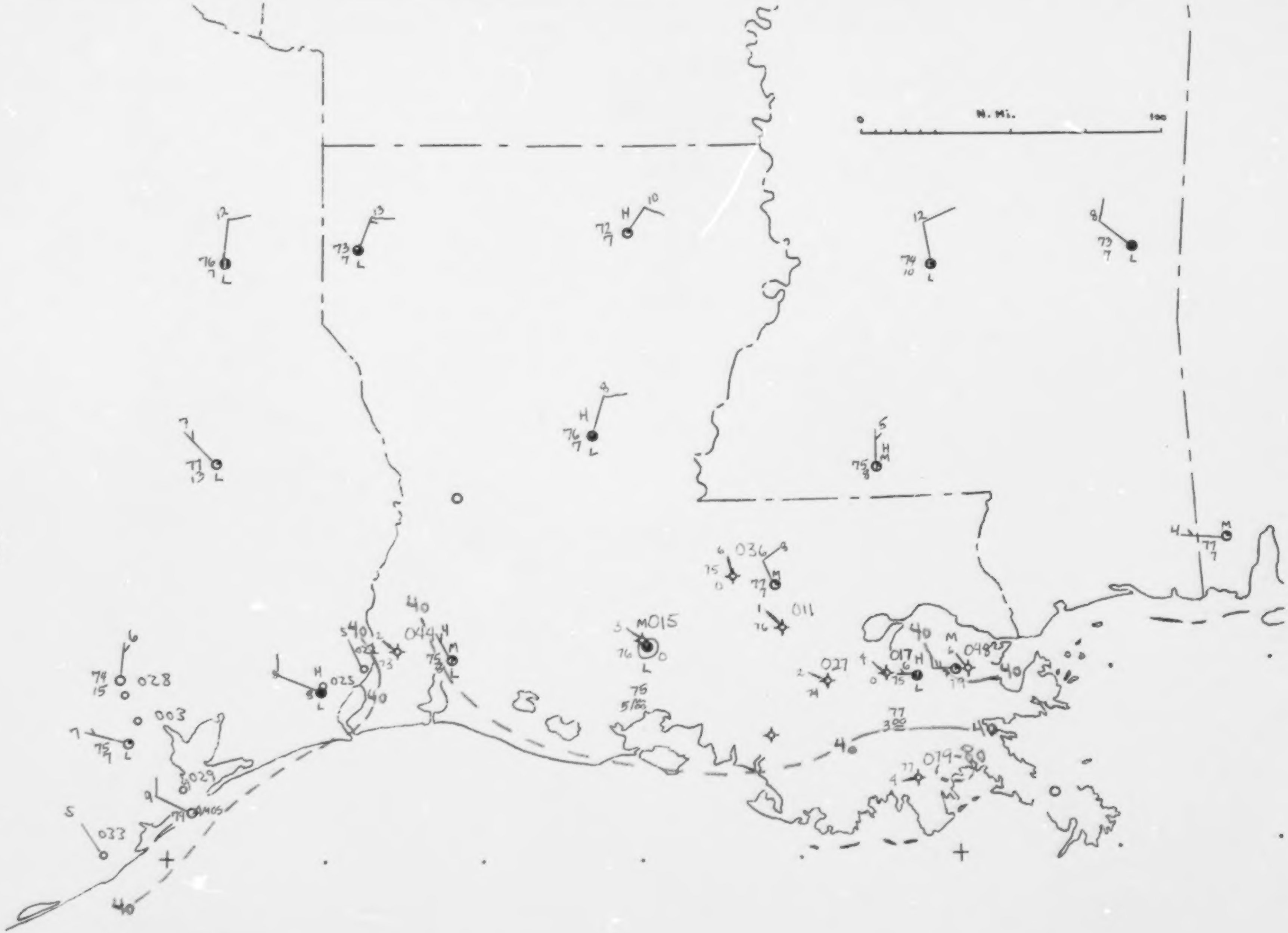
SURFACE OZONE AND WEATHER
9-9-76
23 CDT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036
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029
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SURFACE OZONE AND WEATHER
9-10-76
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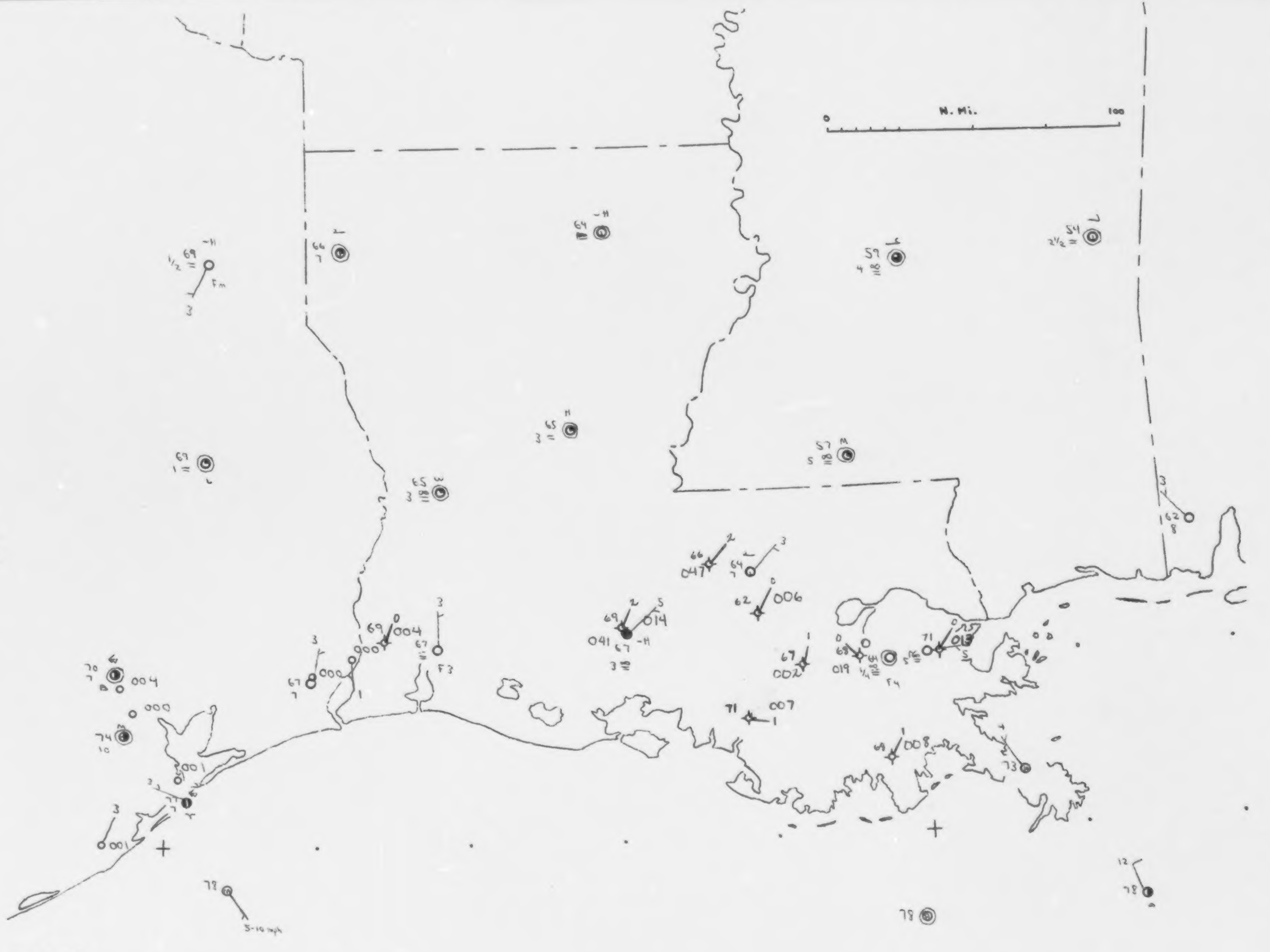
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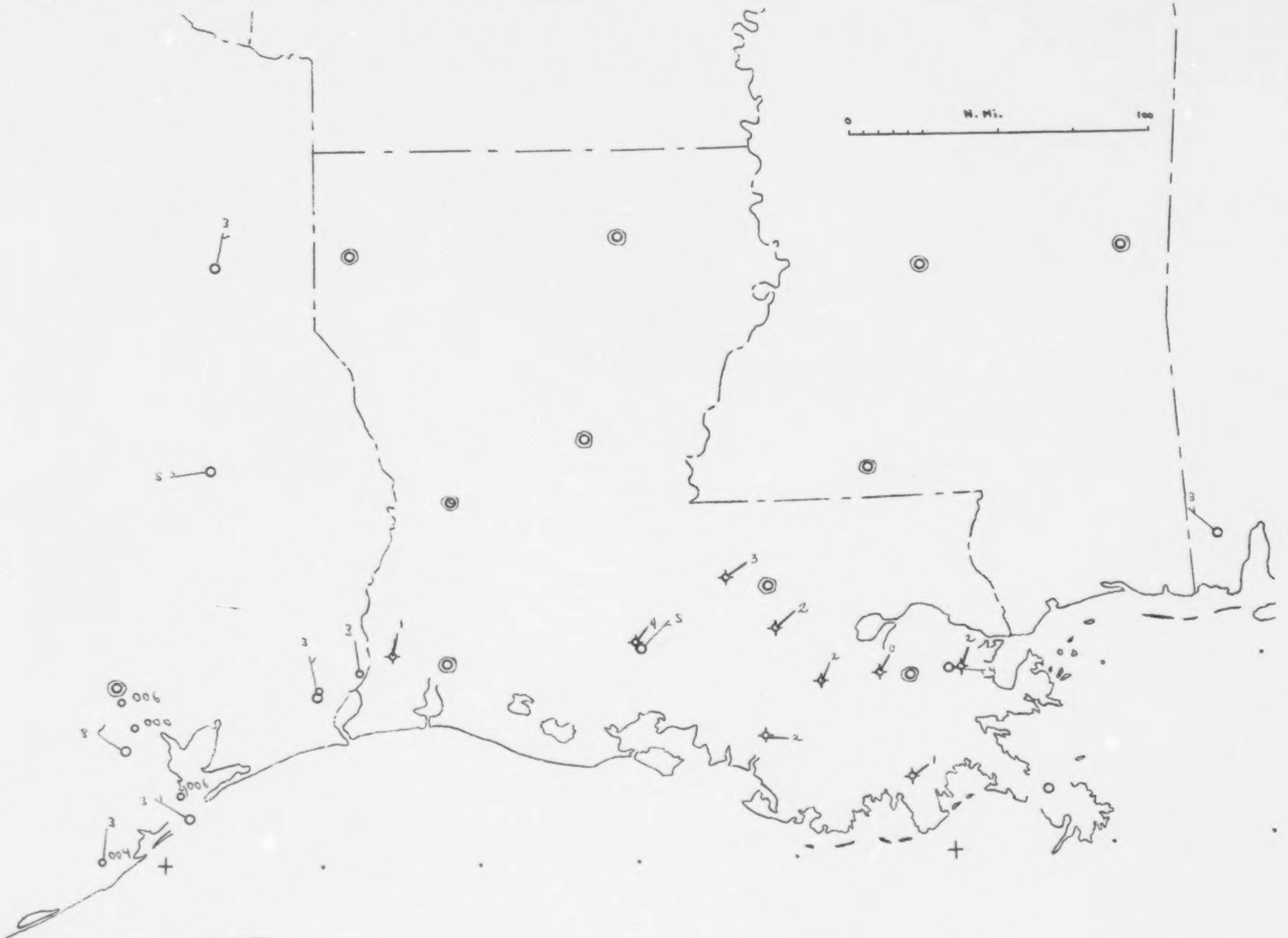
9-16-76
07 CDT
SURFACE OZONE AND WEATHER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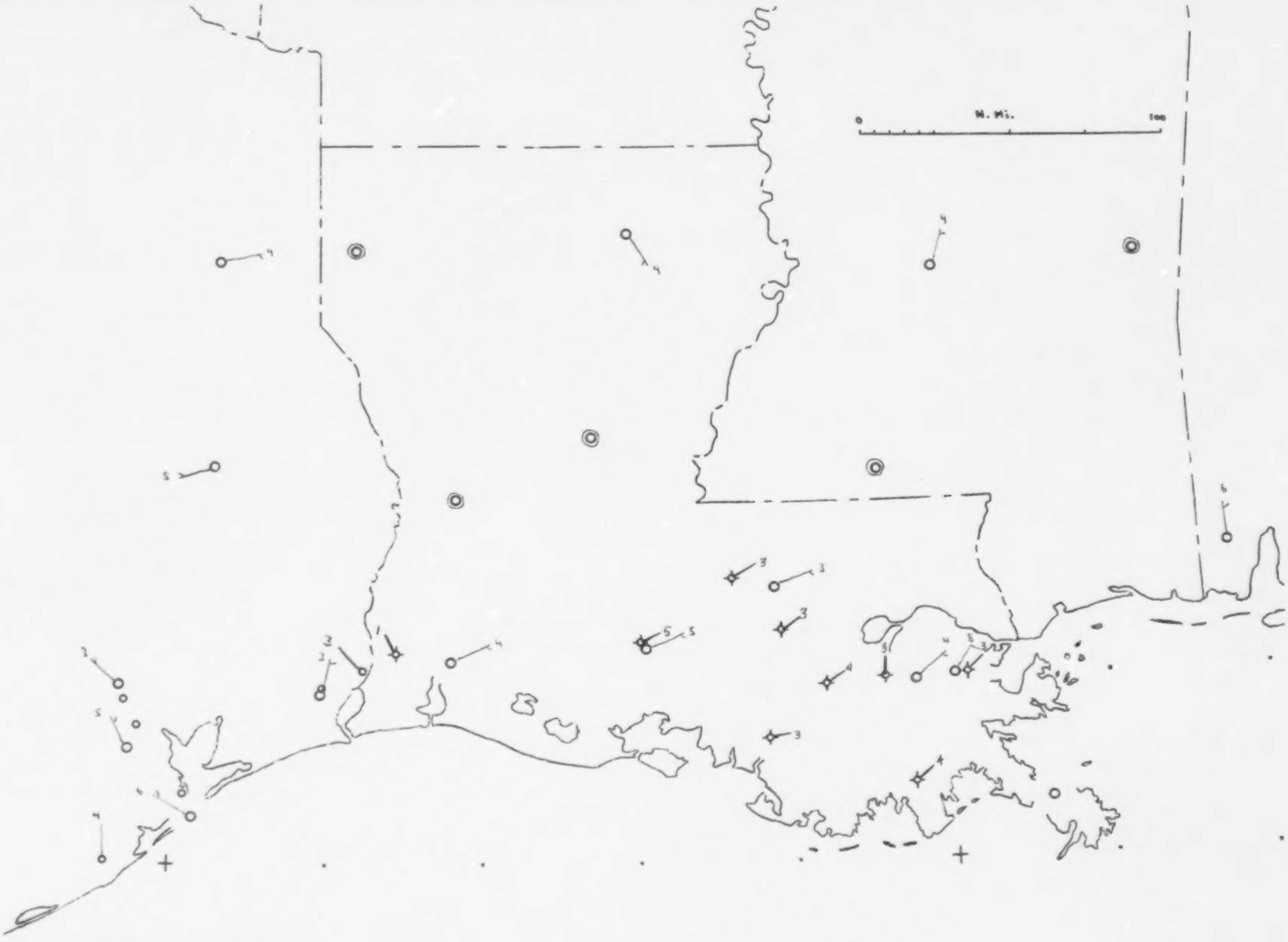
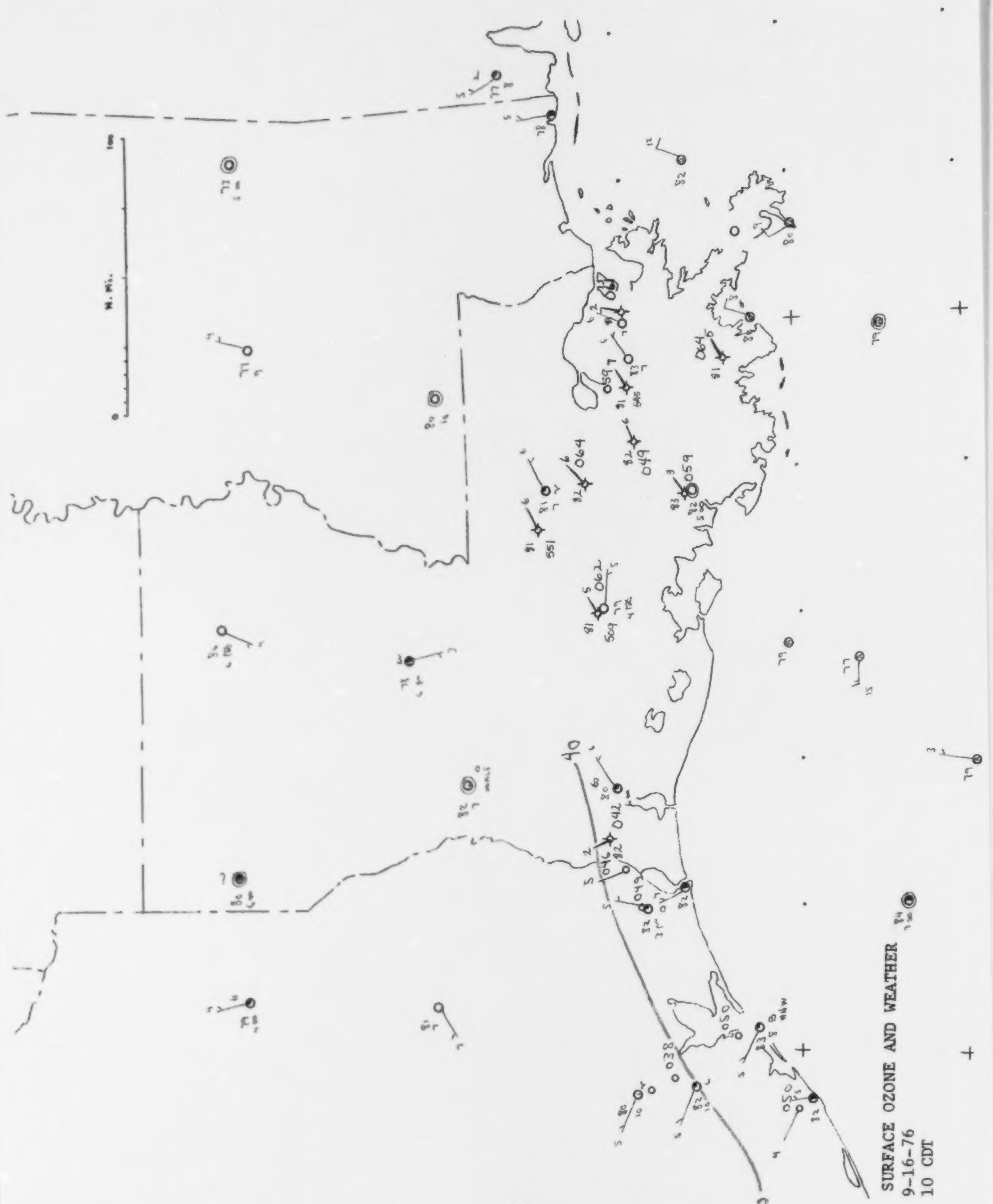
SURFACE OZONE AND WEATHER
9-16-76
08 CDT



SURFACE OZONE AND WEATHER
9-16-76
09 CDT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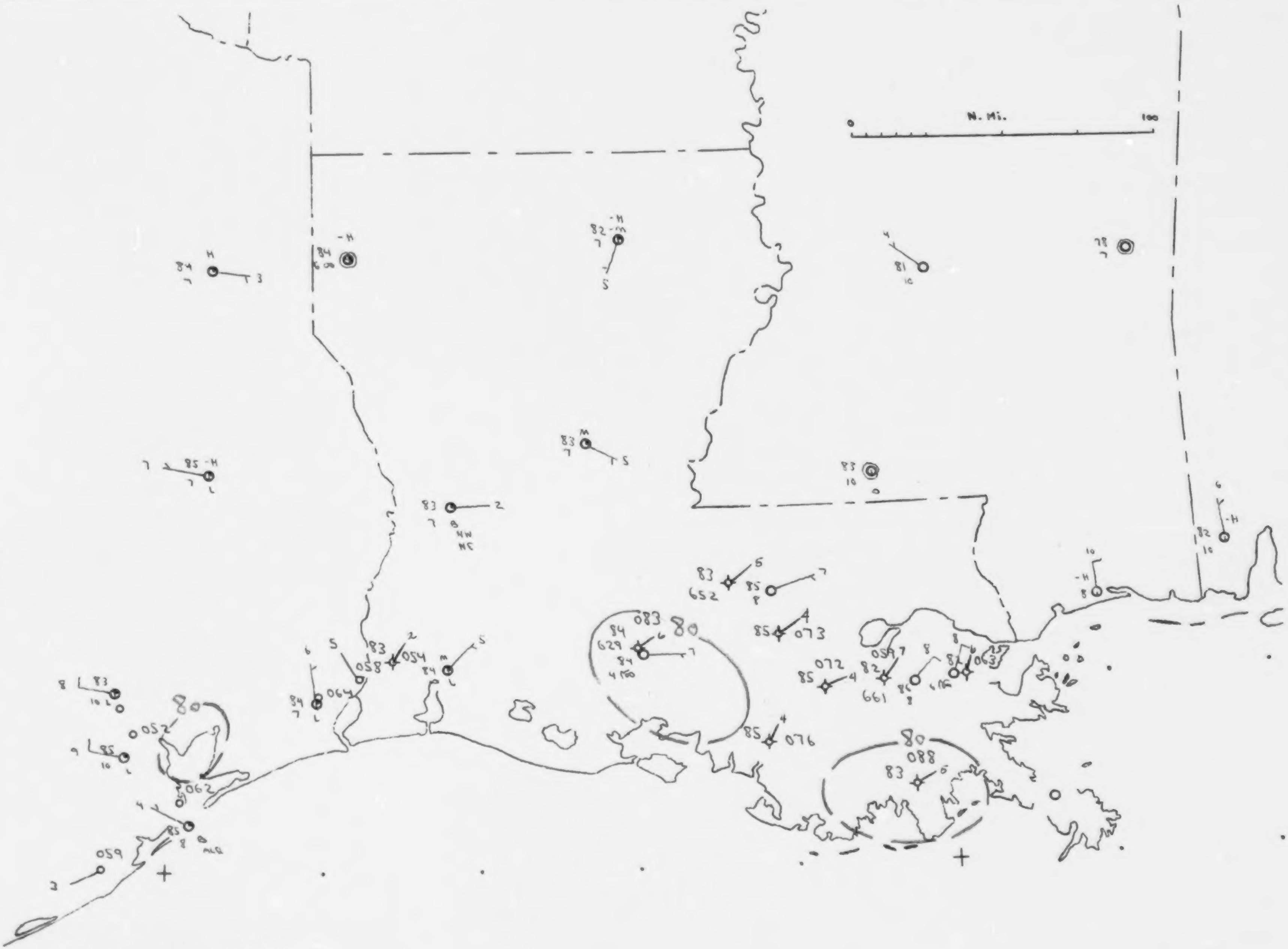
SURFACE OZONE AND WEATHER
9-16-76
10 CDT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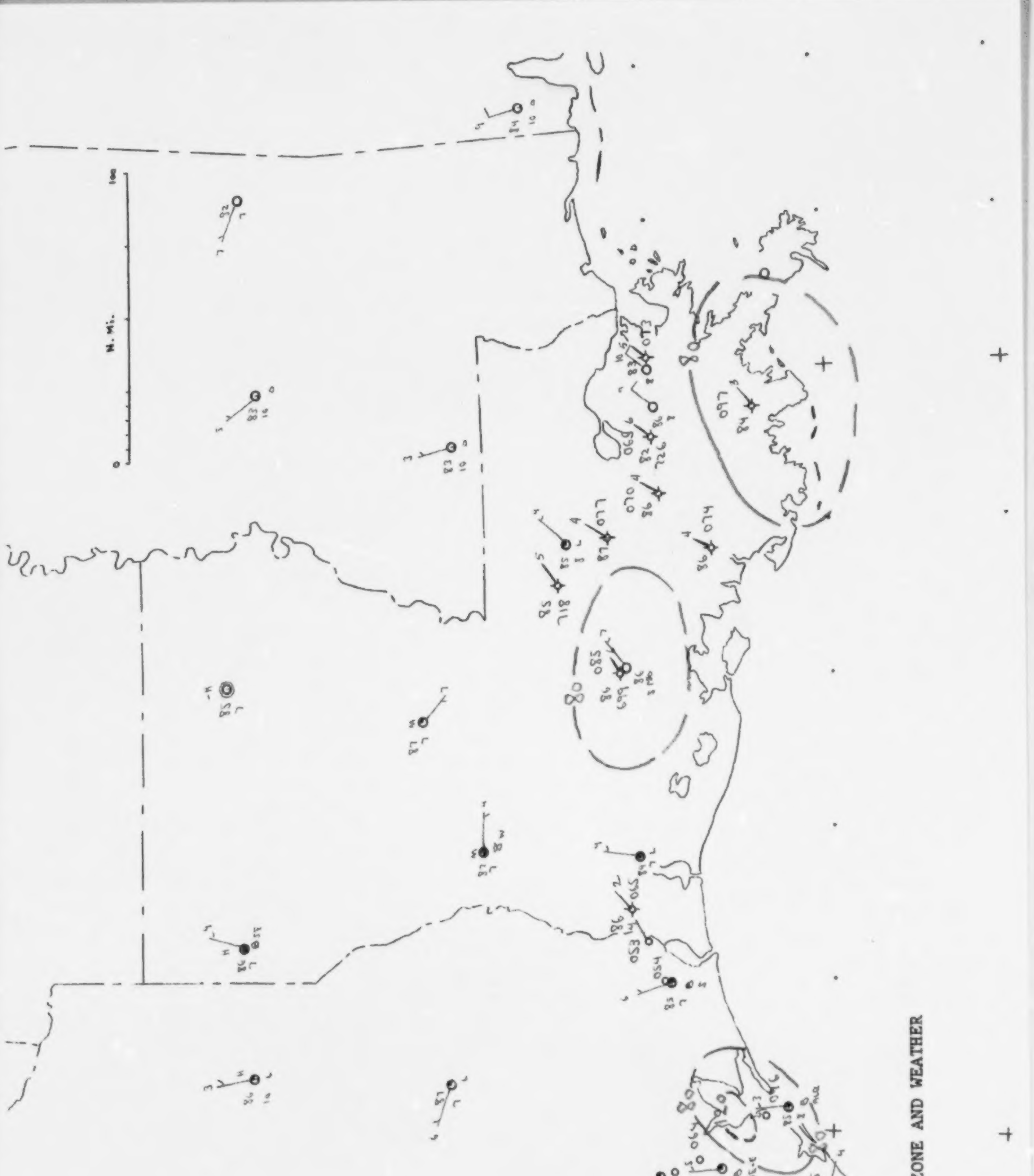
SURFACE OZONE AND WEATHER
9-16-76
11 CDT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SURFACE OZONE AND WEATHER
9-16-76
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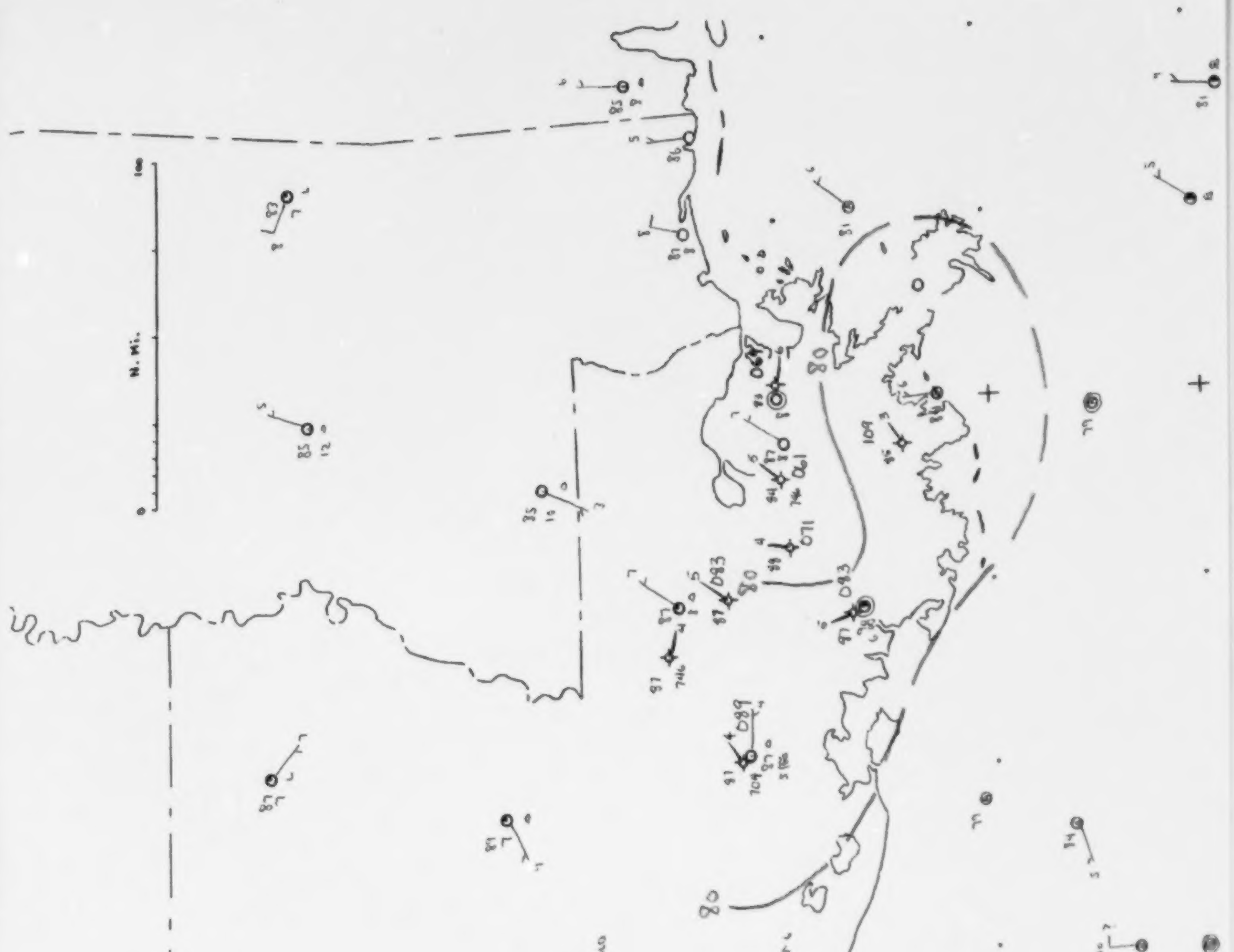
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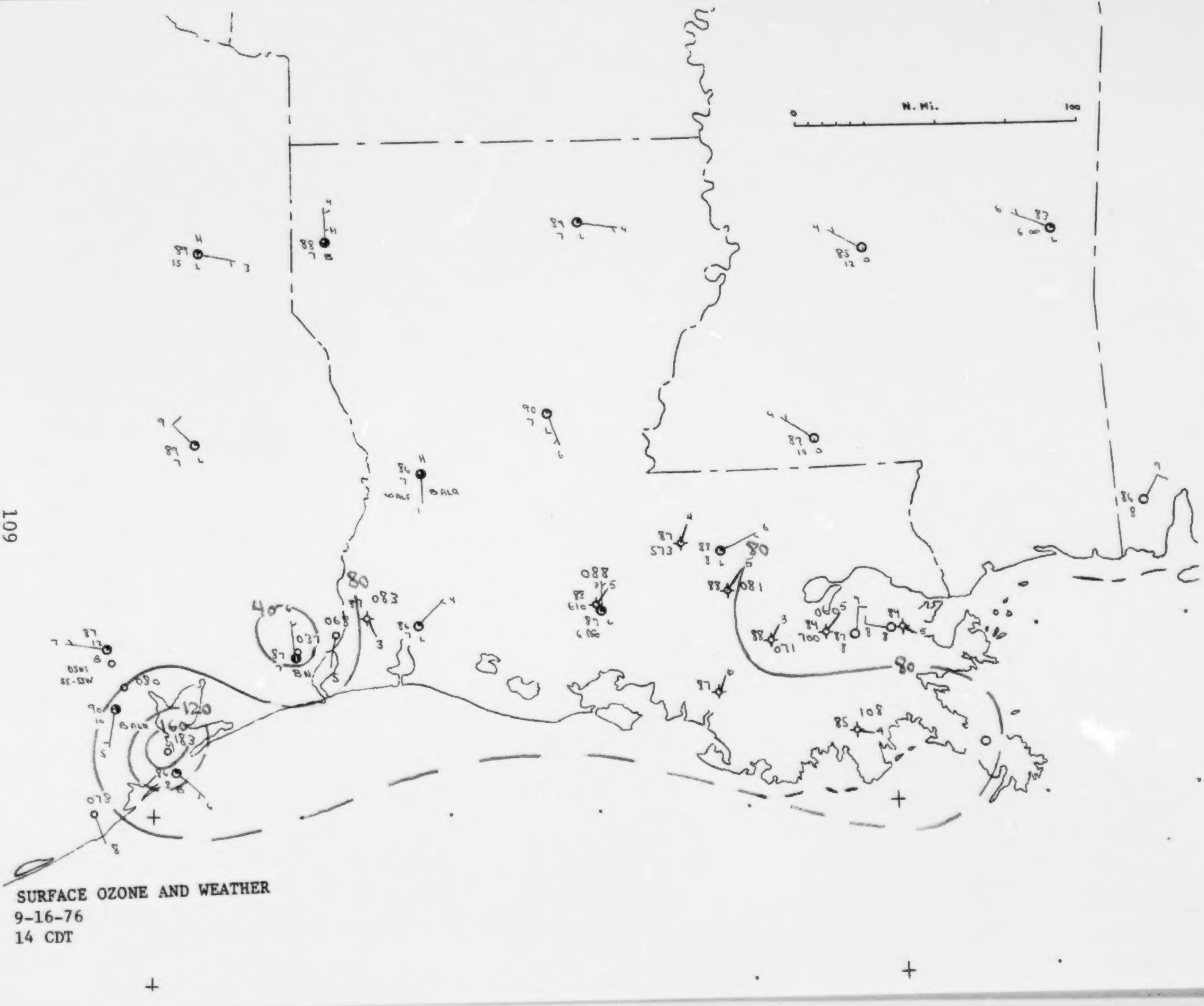
SURFACE OZONE AND WEATHER
9-16-76
13 CDT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SURFACE OZONE AND WEATHER
9-16-76
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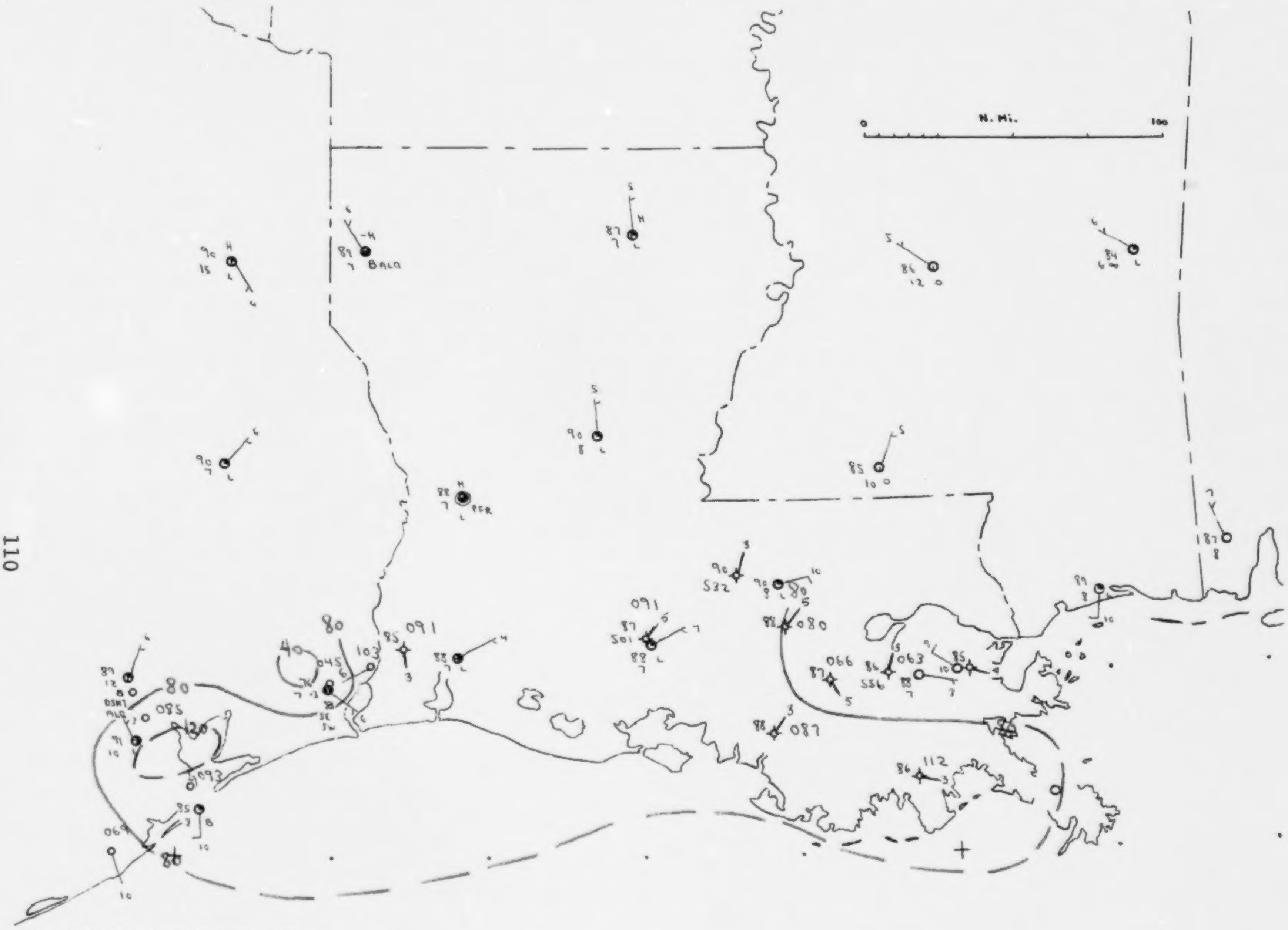
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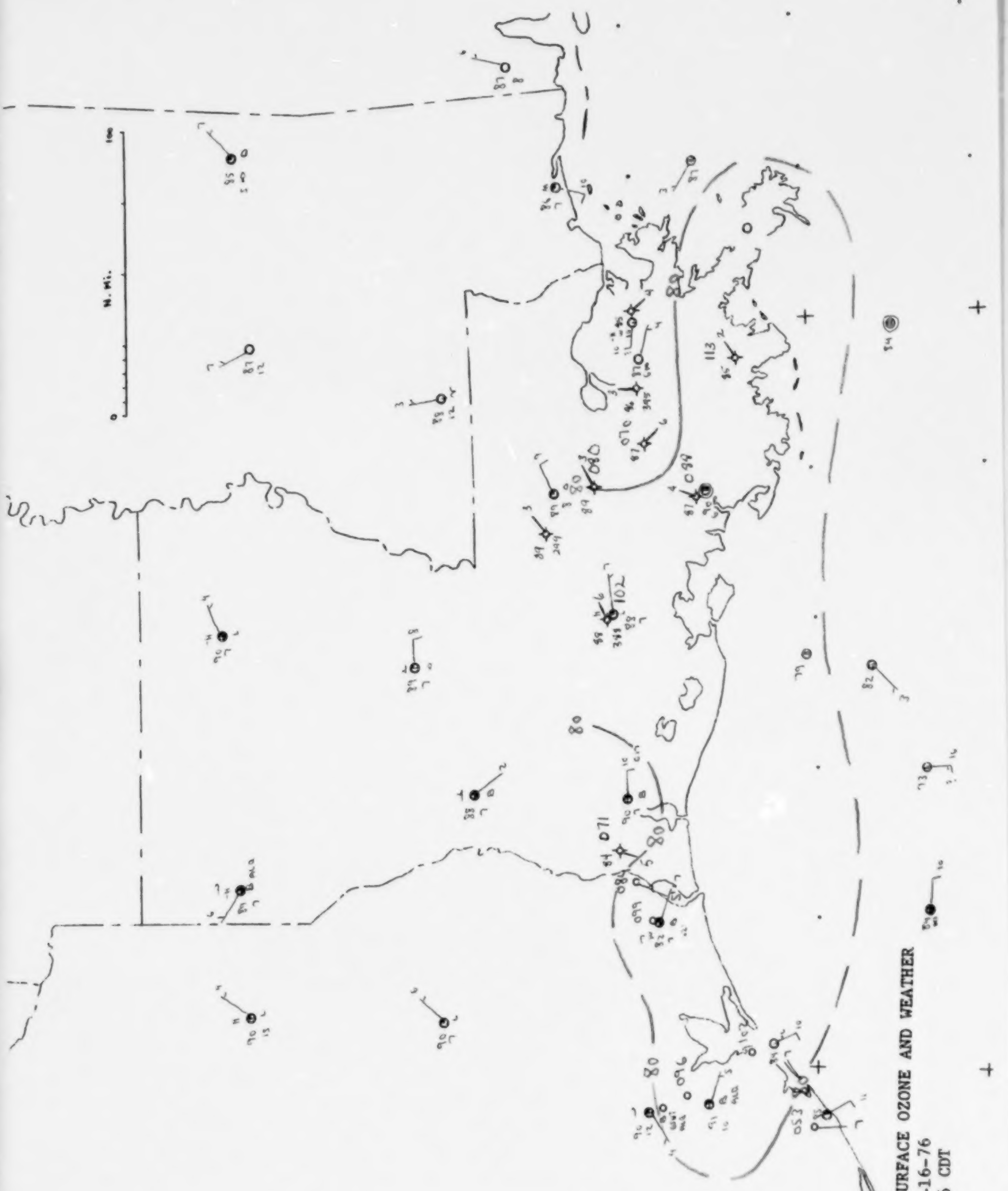
SURFACE OZONE AND WEATHER
9-16-76
15 CDT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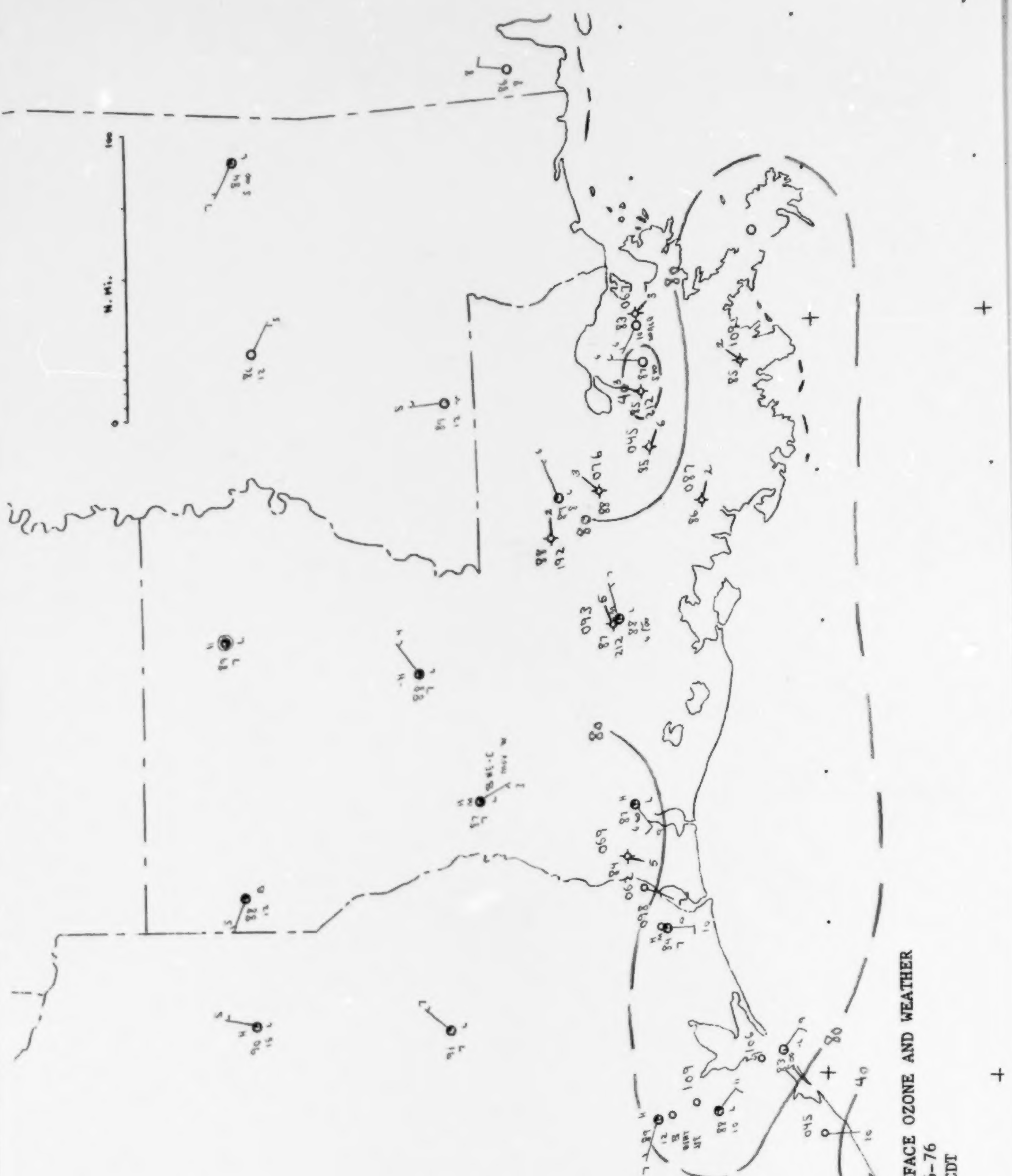
SURFACE OZONE AND WEATHER
9-16-76
16 CDT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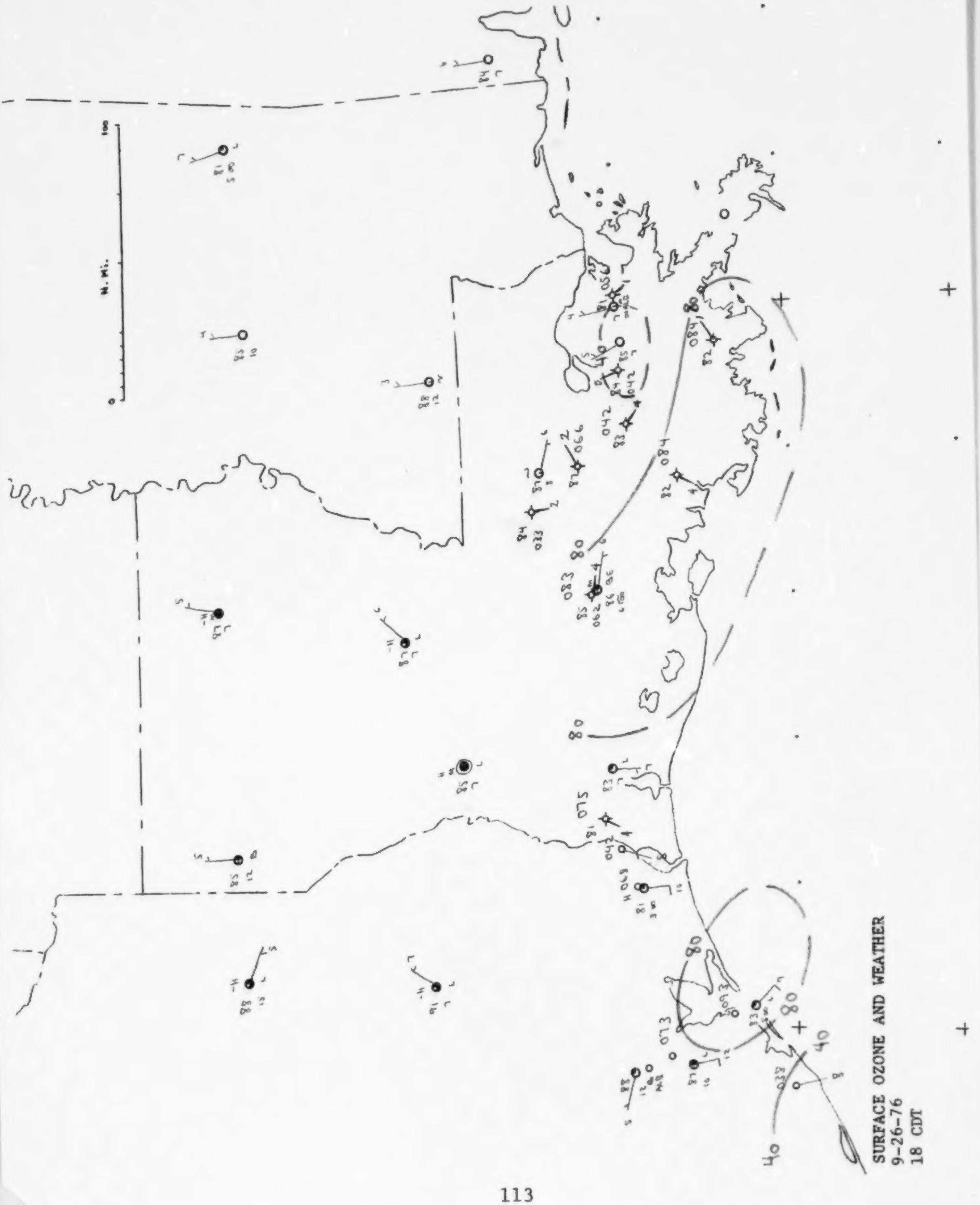
SURFACE OZONE AND WEATHER
9-16-76
17 CDT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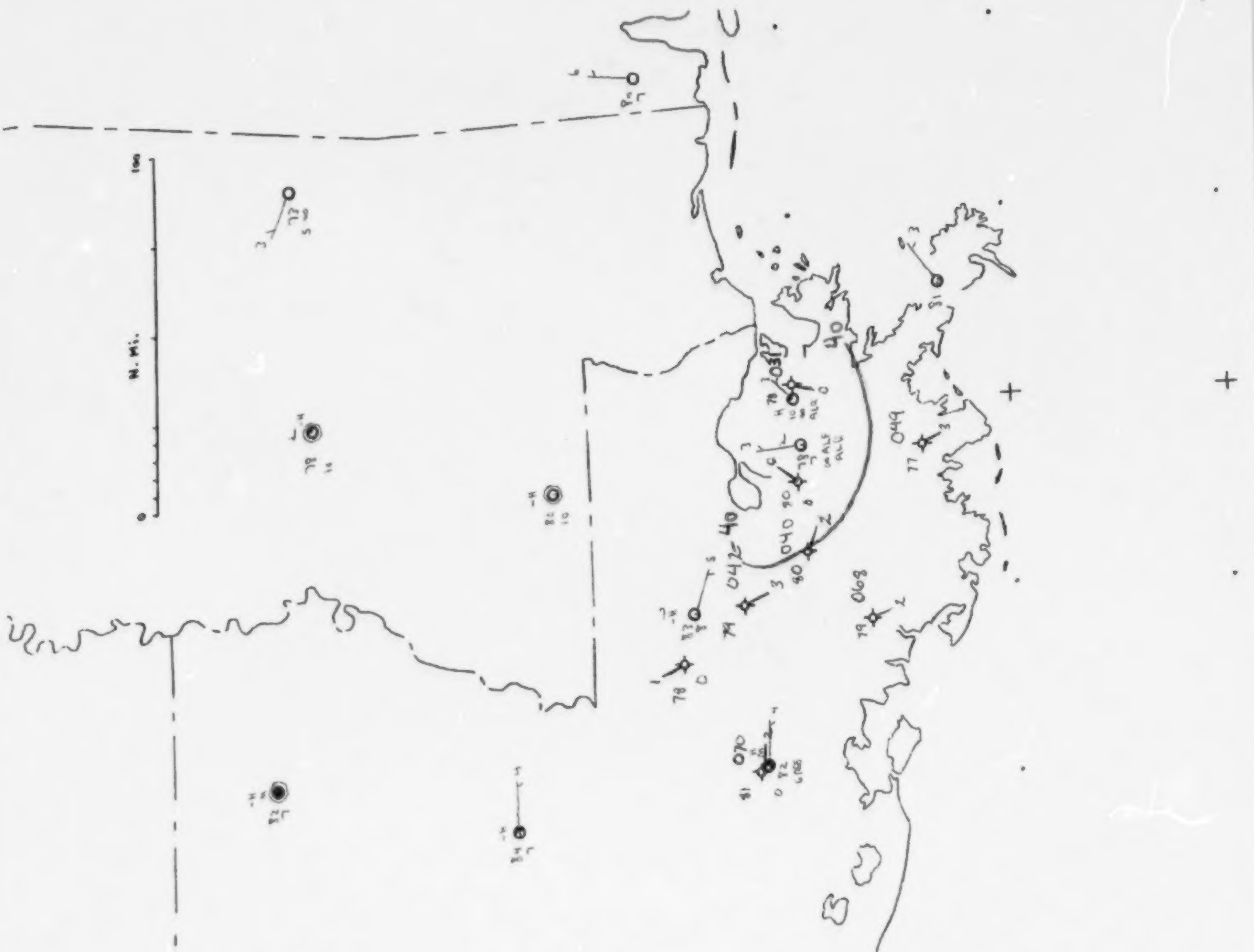
062
033

SURFACE OZONE AND WEATHER
9-26-76
18 CDT

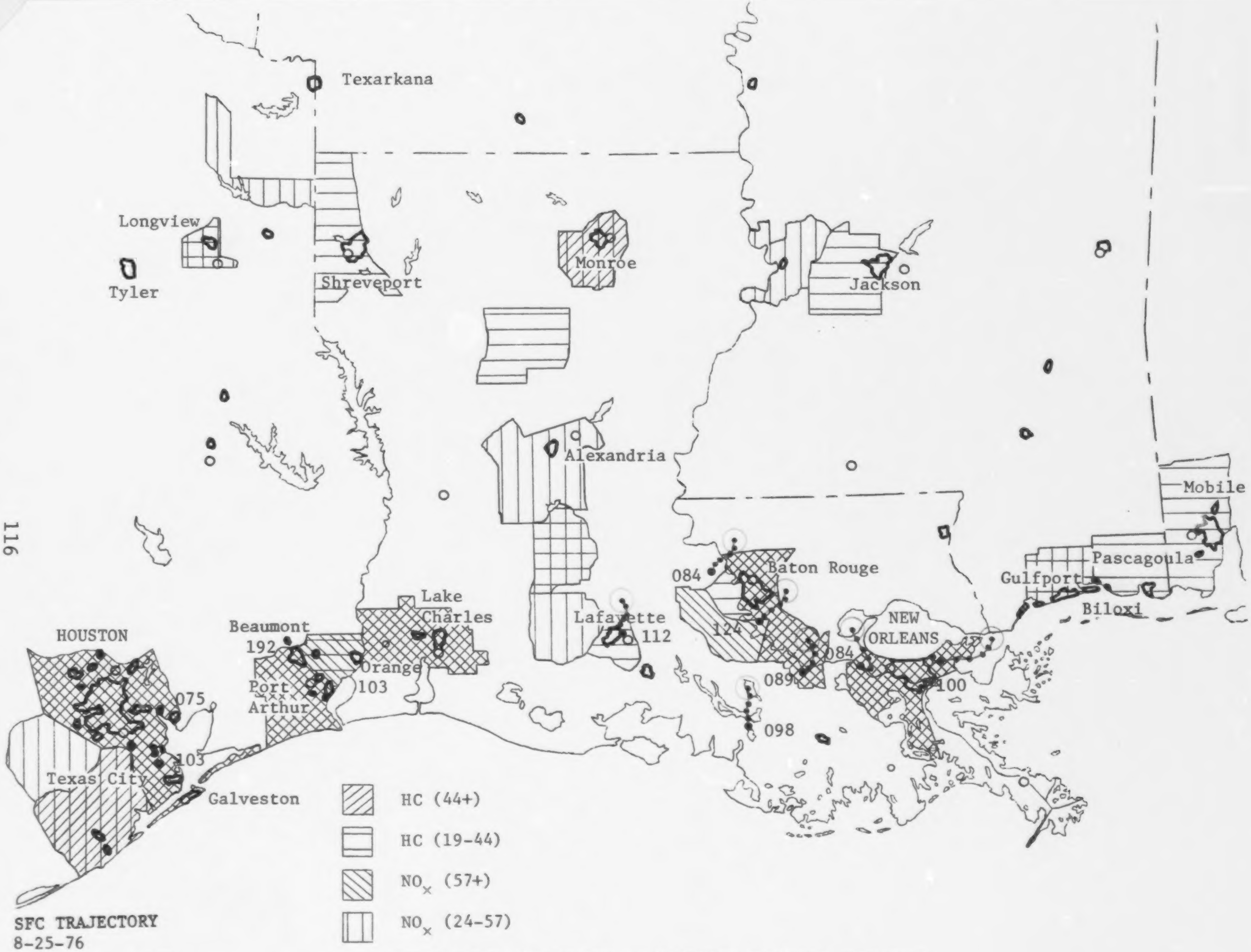

N. Mi.
100
40
40
042
040
031
049
068
070
047
009
053
073
051
039
40
40

SURFACE OZONE AND WEATHER
9-16-76
19 CDT

APPENDIX C

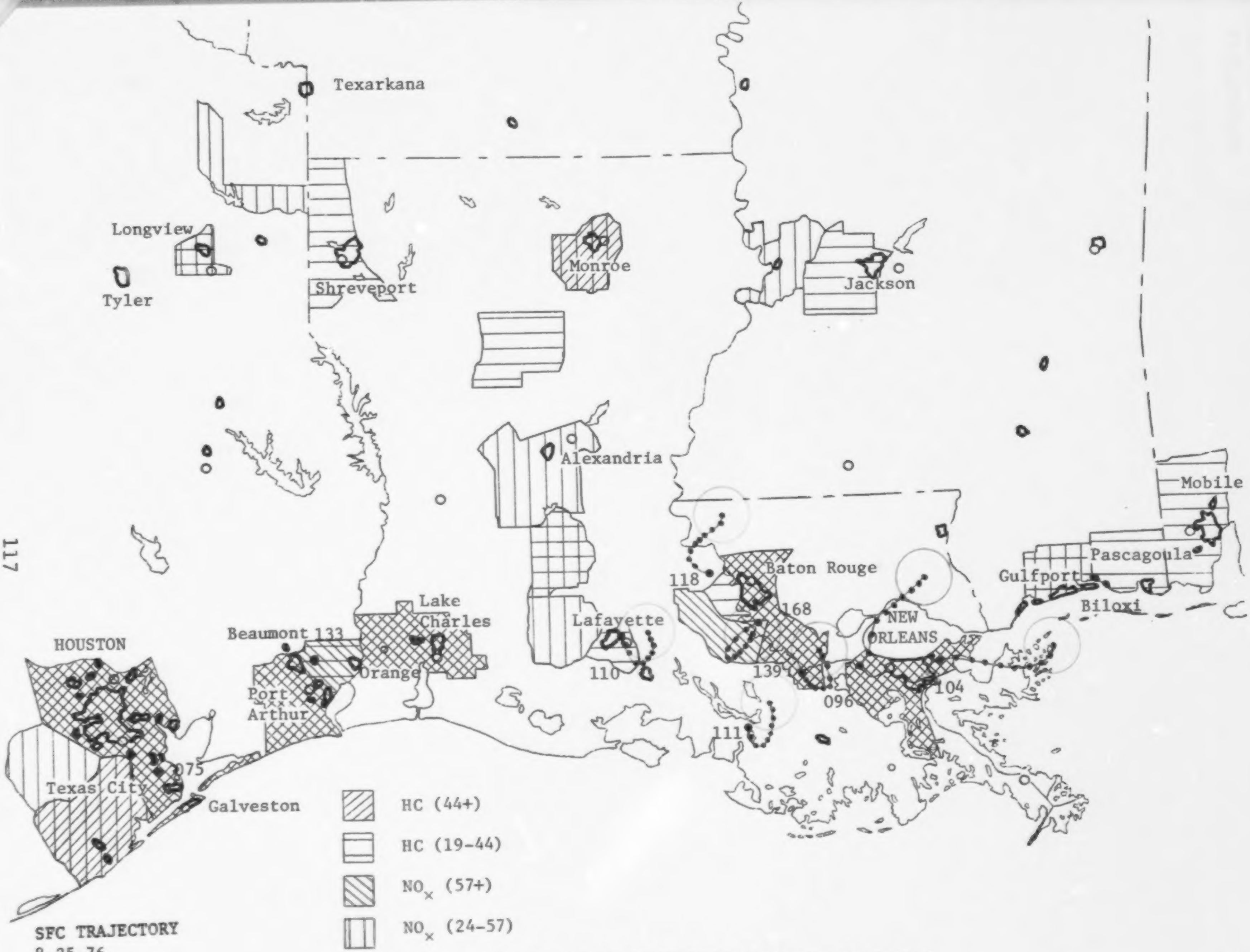
Surface trajectories derived by graphical methods are plotted in Appendix C. All trajectories are backwards in time with dots along the trajectory indicating hourly positions. A circle is plotted at the end (earliest time position) of the trajectory to give an approximate error range at that point (± one mile is allowed for each hour). Also, the ozone level is plotted for the hour ending at the time of arrival of the air mass at the trailer site. All trajectories end at 6 a.m. CDT, with the arrival time given in the map title.

The base map shows urban areas outlined with a heavy black boundary, and emission densities of hydrocarbons (HC) and oxides of nitrogen (NO_x) as listed, by parish or county, as obtained from the EPA.


Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
084
124
NEW ORLEANS
084
089
100
098
Lafayette
112
Lake Charles
Beaumont
192
Orange
103
Port Arthur
HOUSTON
075
103
Texas City
Galveston
HC (44+)
HC (19-44)
NO$_x$ (57+)
NO$_x$ (24-57)

SFC TRAJECTORY
8-25-76
6 am - 11 am CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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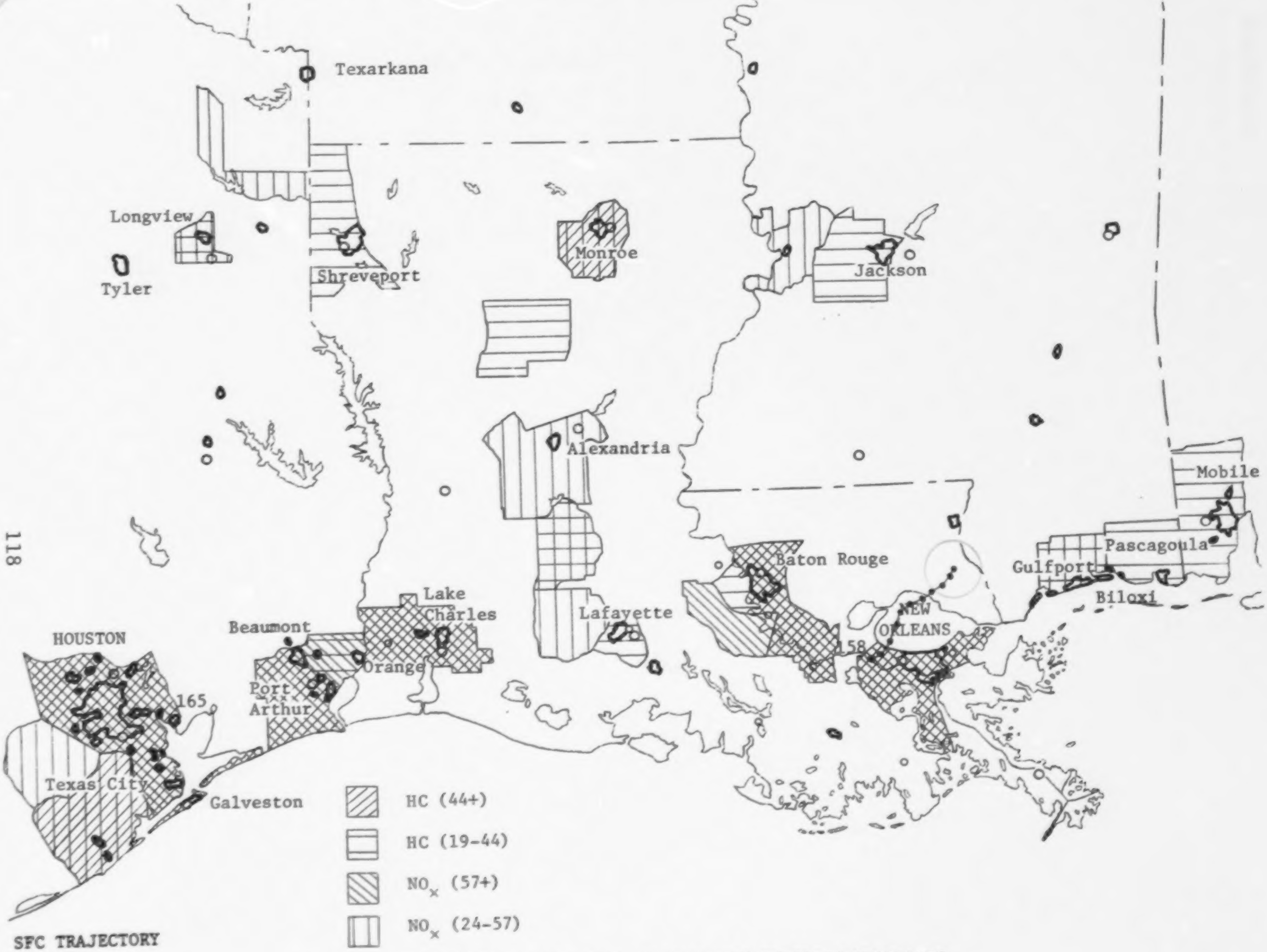
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
118
168
NEW ORLEANS
104
096
139
111
Lafayette
110
Lake Charles
Beaumont 133
Orange
Port Arthur
HOUSTON
Texas City
075
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NO_x (57+)
▥ NO_x (24-57)

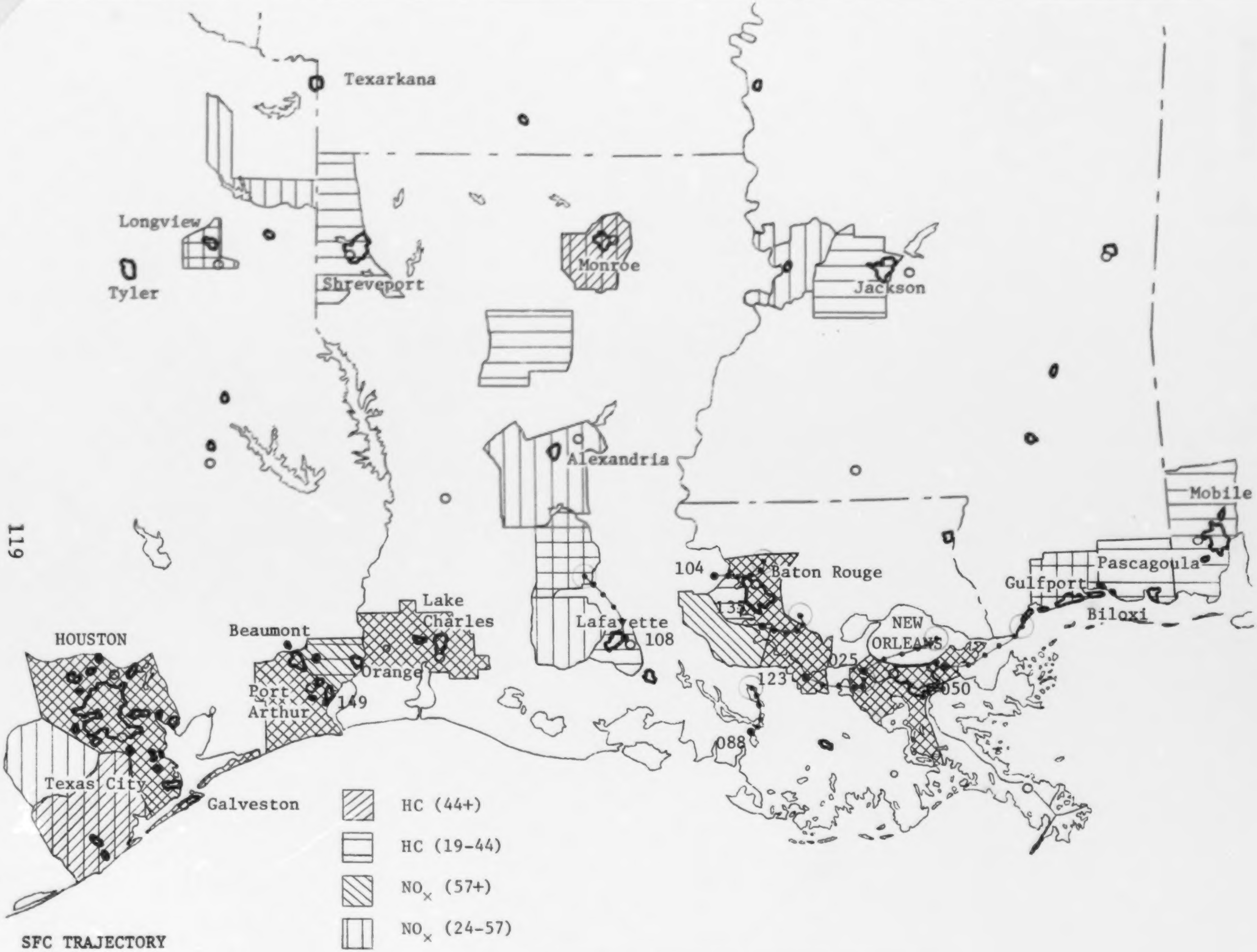
SFC TRAJECTORY
8-25-76
6 am - 3 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)


Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
158
Lake Charles
Lafayette
Beaumont
Orange
Port Arthur
HOUSTON
165
Texas City
Galveston
HC (44+)
HC (19-44)
NO$_x$ (57+)
NO$_x$ (24-57)

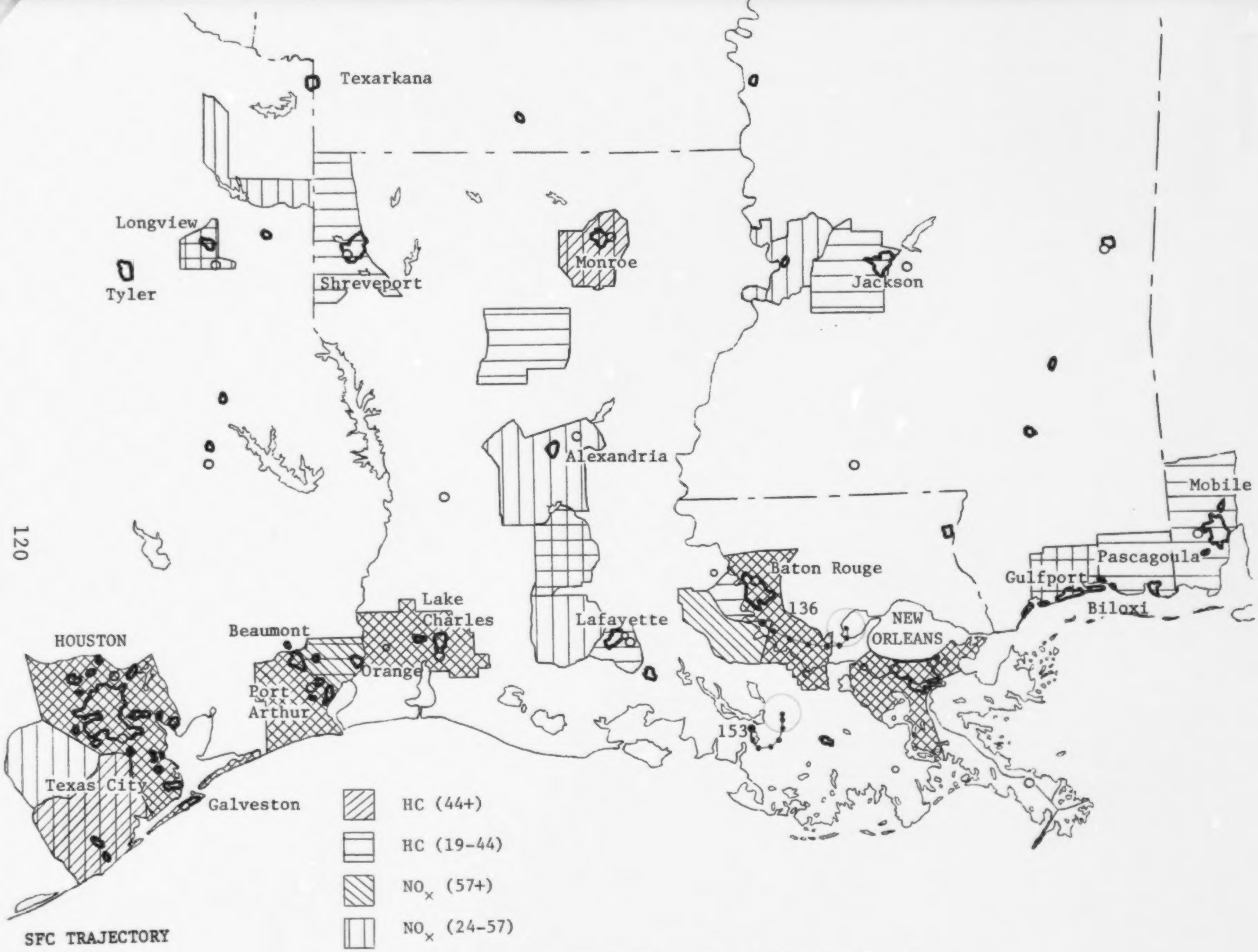
SFC TRAJECTORY
8-25-76
6 am - 4 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)


Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
104
132
NEW ORLEANS
025
123
050
088
Lafayette
108
Lake Charles
Beaumont
Orange
Port Arthur
149
HOUSTON
Texas City
Galveston
▨ HC (44+)
▤ HC (19-44)
▨ NO$_x$ (57+)
▥ NO$_x$ (24-57)

SFC TRAJECTORY
8-26-76
6 am - 11 am CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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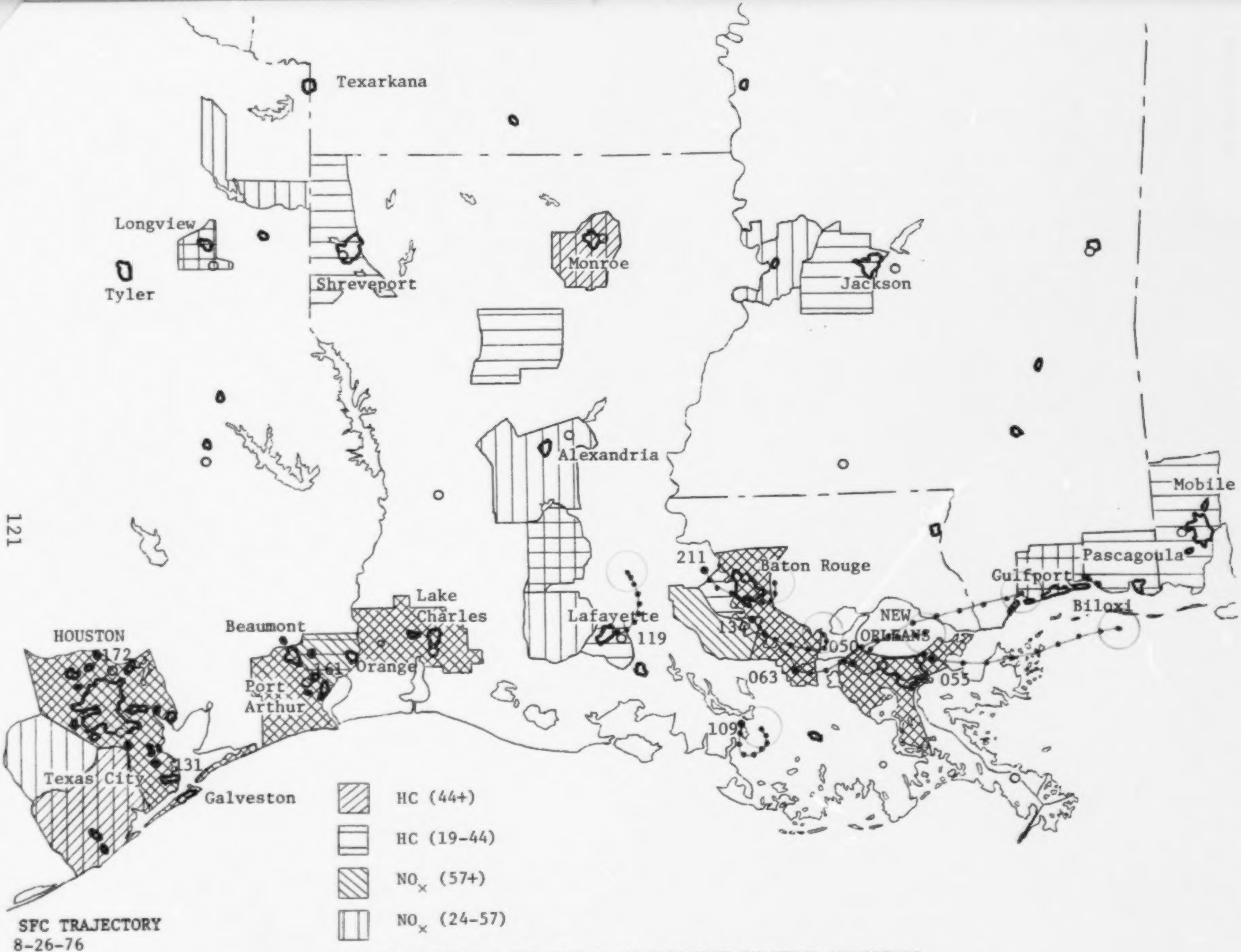
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Baton Rouge
Pascagoula
Gulfport
Biloxi
136
NEW ORLEANS
Lake Charles
Lafayette
HOUSTON
Beaumont
Orange
Port Arthur
153
Texas City
Galveston
HC (44+)
HC (19-44)
NO$_x$ (57+)
NO$_x$ (24-57)

SFC TRAJECTORY
8-26-76
6 am - 1 pm CDT

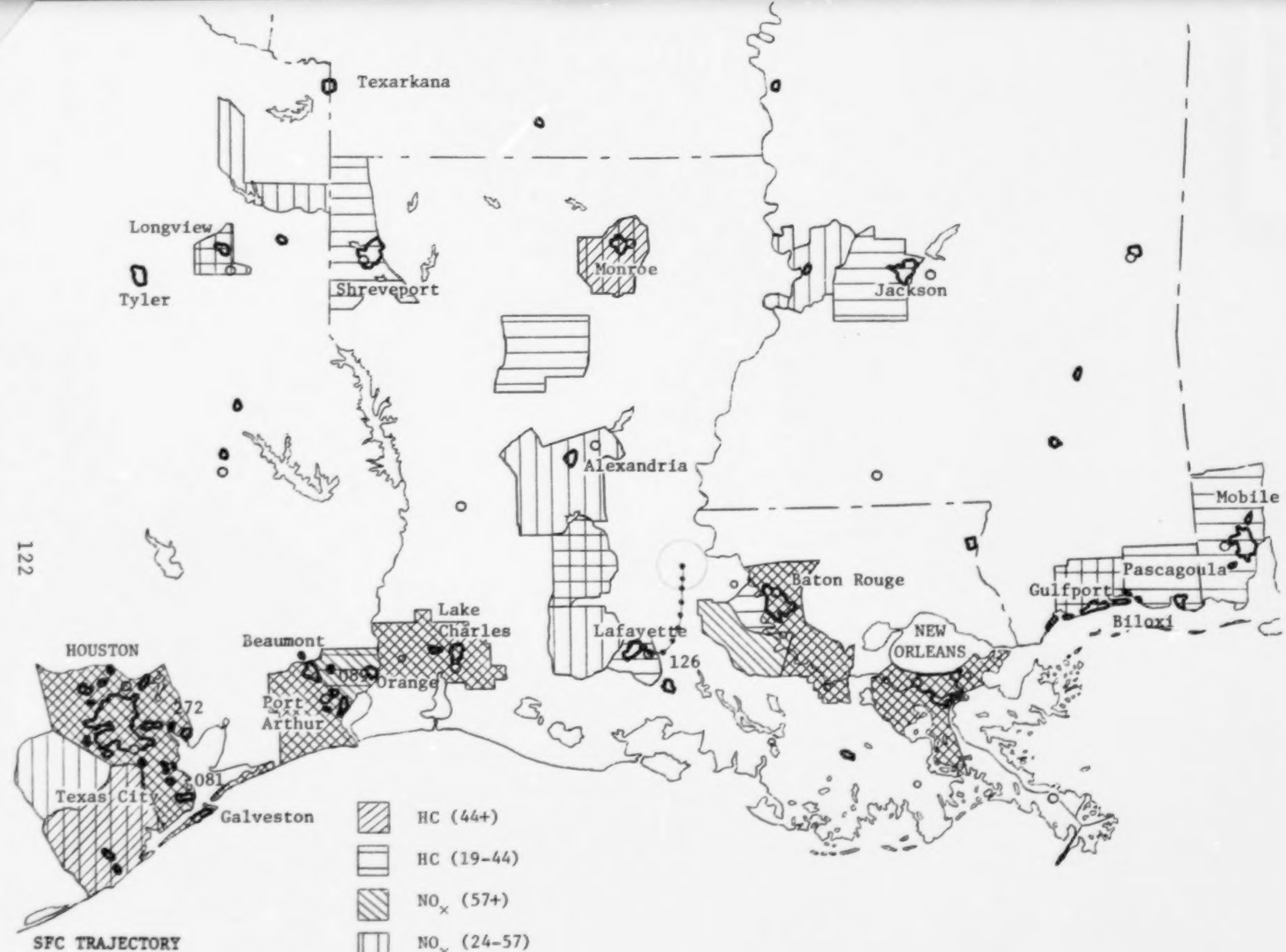
HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)



Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
211
Baton Rouge
Pascagoula
Gulfport
Biloxi
NEW ORLEANS
Lafayette
119
134
050
063
055
109
HOUSTON
172
Beaumont
Lake Charles
161
Orange
Port Arthur
131
Texas City
Galveston
HC (44+)
HC (19-44)
NO$_x$ (57+)
NO$_x$ (24-57)

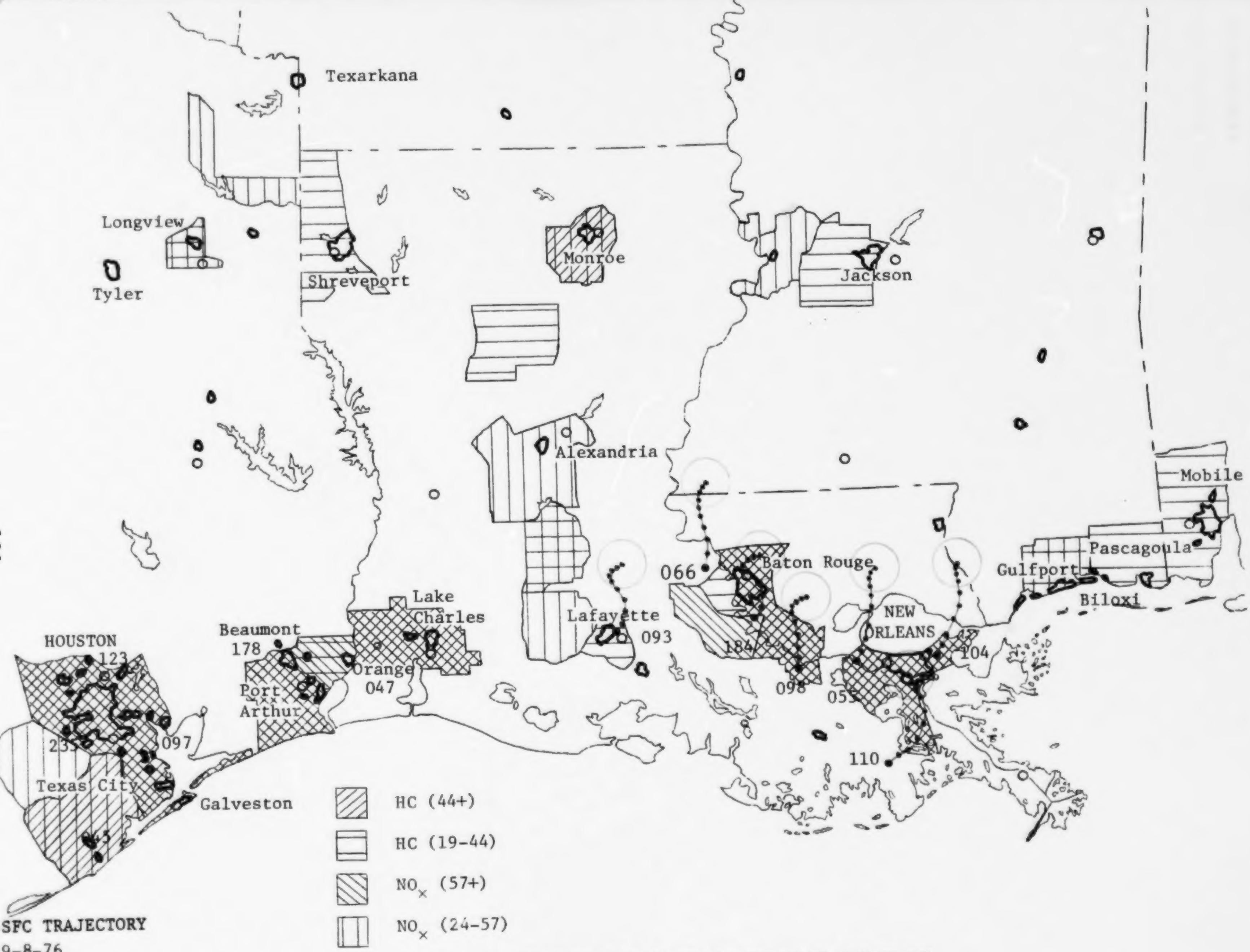
SFC TRAJECTORY
8-26-76
6 am - 2 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)


Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
Lafayette
126
Lake Charles
Beaumont
Orange
081
Port Arthur
HOUSTON
272
081
Texas City
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NO_x (57+)
▥ NO_x (24-57)

SFC TRAJECTORY
8-26-76
6 am - 3 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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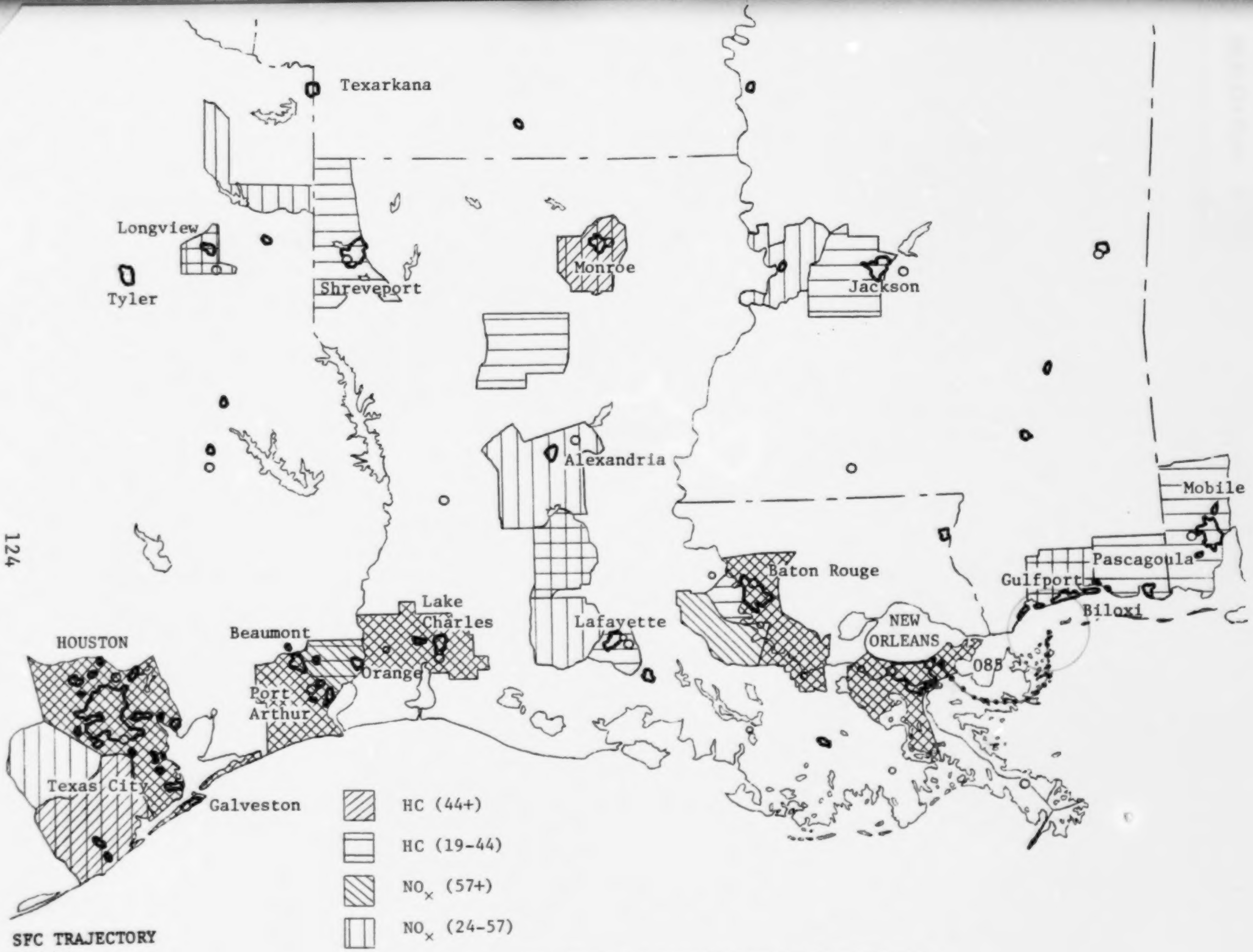
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
066
NEW ORLEANS
104
184
098
055
110
Lafayette
093
Lake Charles
Beaumont
178
Orange
047
Port Arthur
HOUSTON
123
097
235
Texas City
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NO_x (57+)
▥ NO_x (24-57)

SFC TRAJECTORY
9-8-76
6 am -- 3 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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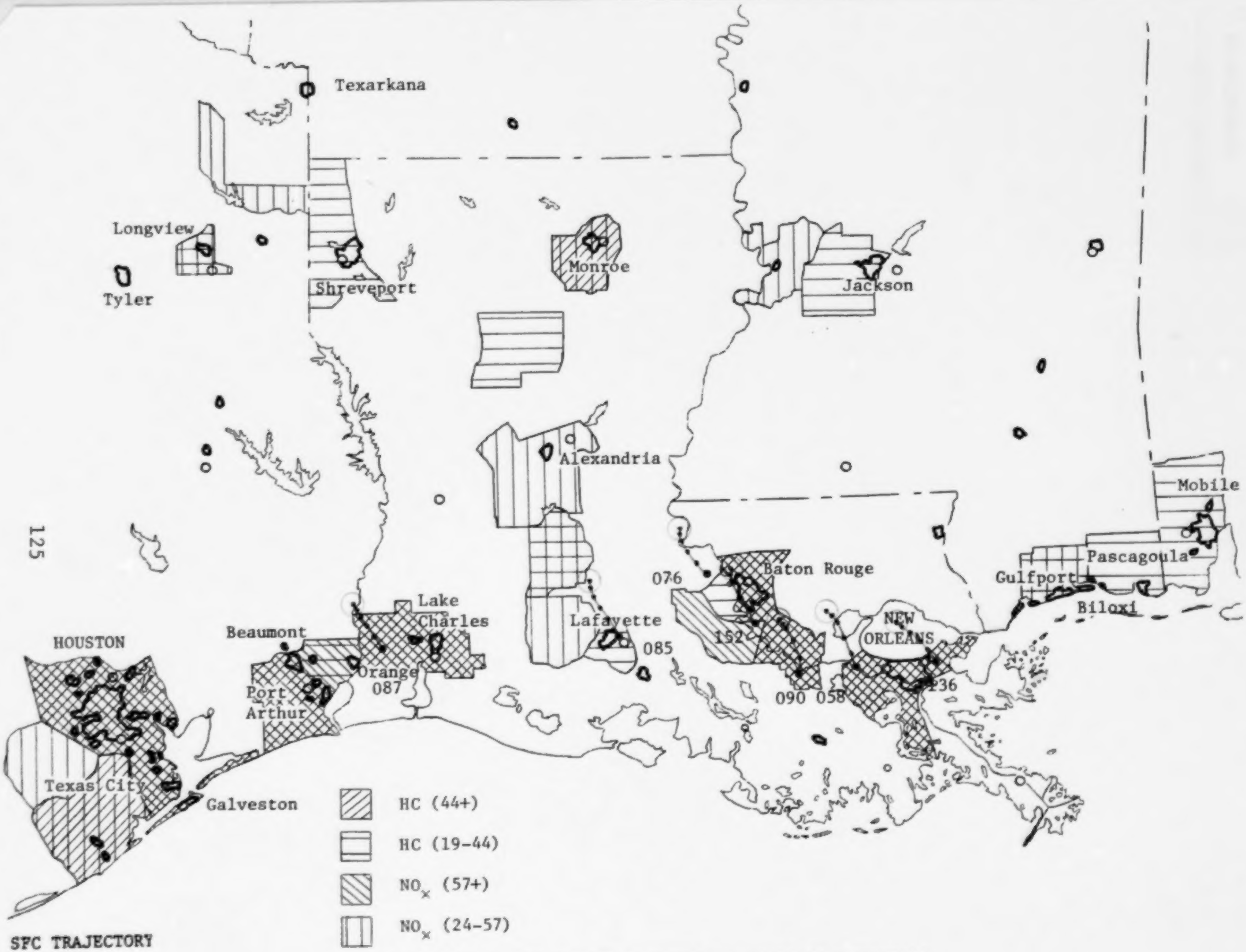
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
085
Lafayette
Lake Charles
Beaumont
Orange
Port Arthur
HOUSTON
Texas City
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NO$_x$ (57+)
▥ NO$_x$ (24-57)

SFC TRAJECTORY
9-8-76
6 am - 9 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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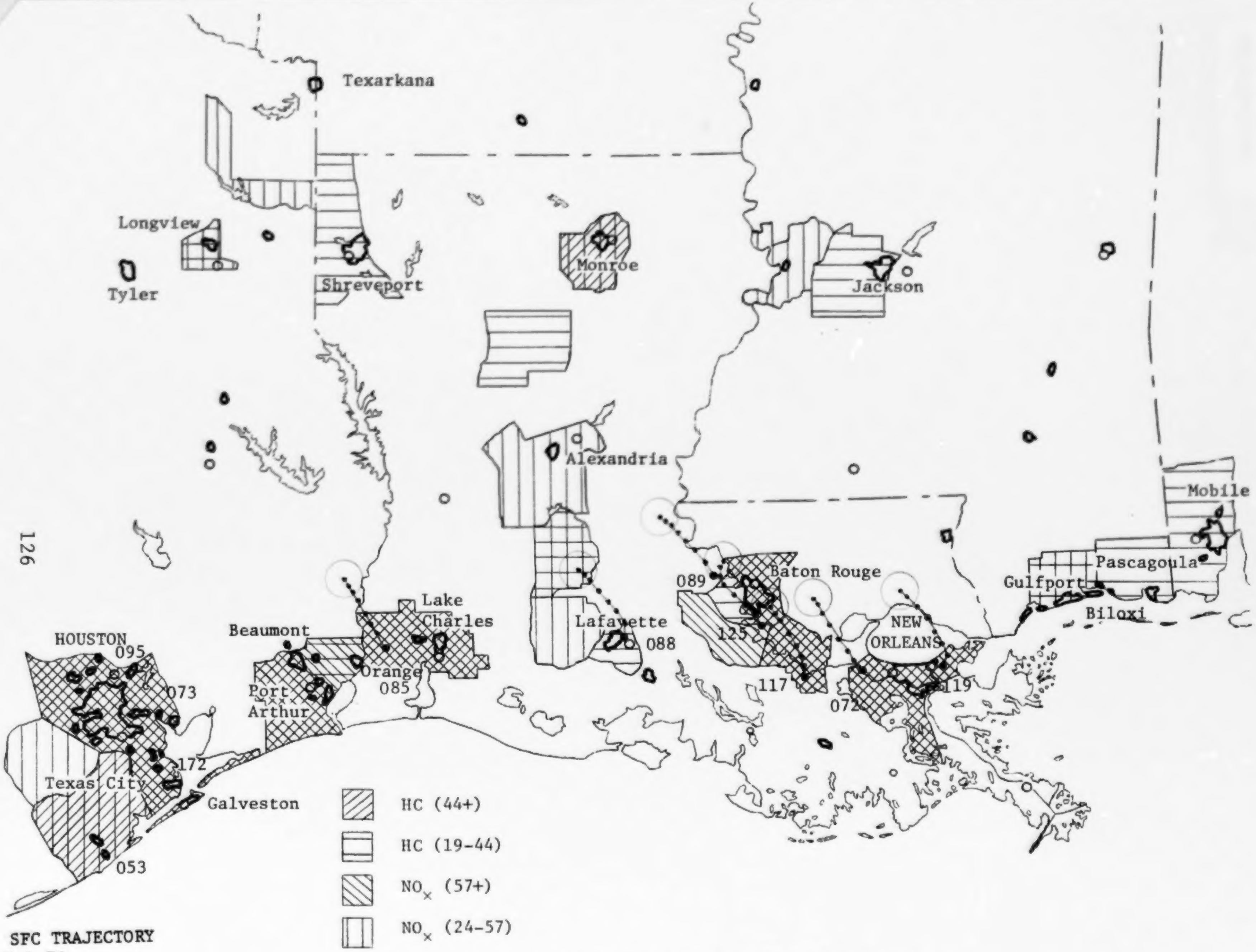
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
076
152
090
058
NEW ORLEANS
236
Lafayette
085
Lake Charles
Beaumont
Orange
087
Port Arthur
HOUSTON
Texas City
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NO_x (57+)
▥ NO_x (24-57)

SFC TRAJECTORY
9-9-76
6 am - 11 am CDT

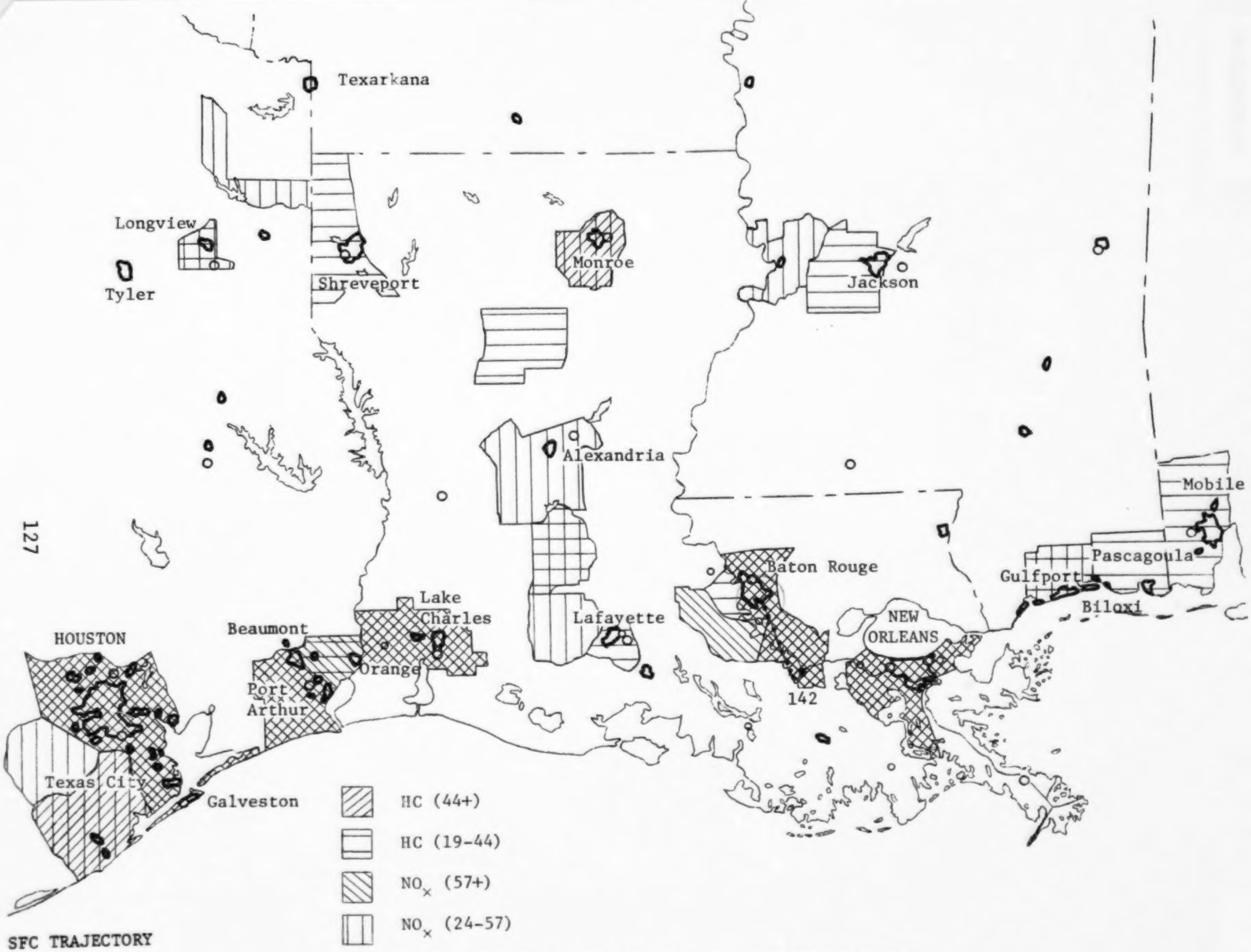
HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)



Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
089
125
117
NEW ORLEANS
072
119
Lafayette
088
Lake Charles
Beaumont
Orange
085
Port Arthur
HOUSTON
095
073
172
Texas City
Galveston
053
▨ HC (44+)
▤ HC (19-44)
▧ NO_x (57+)
▥ NO_x (24-57)

SFC TRAJECTORY
9-9-76
6 am - 1 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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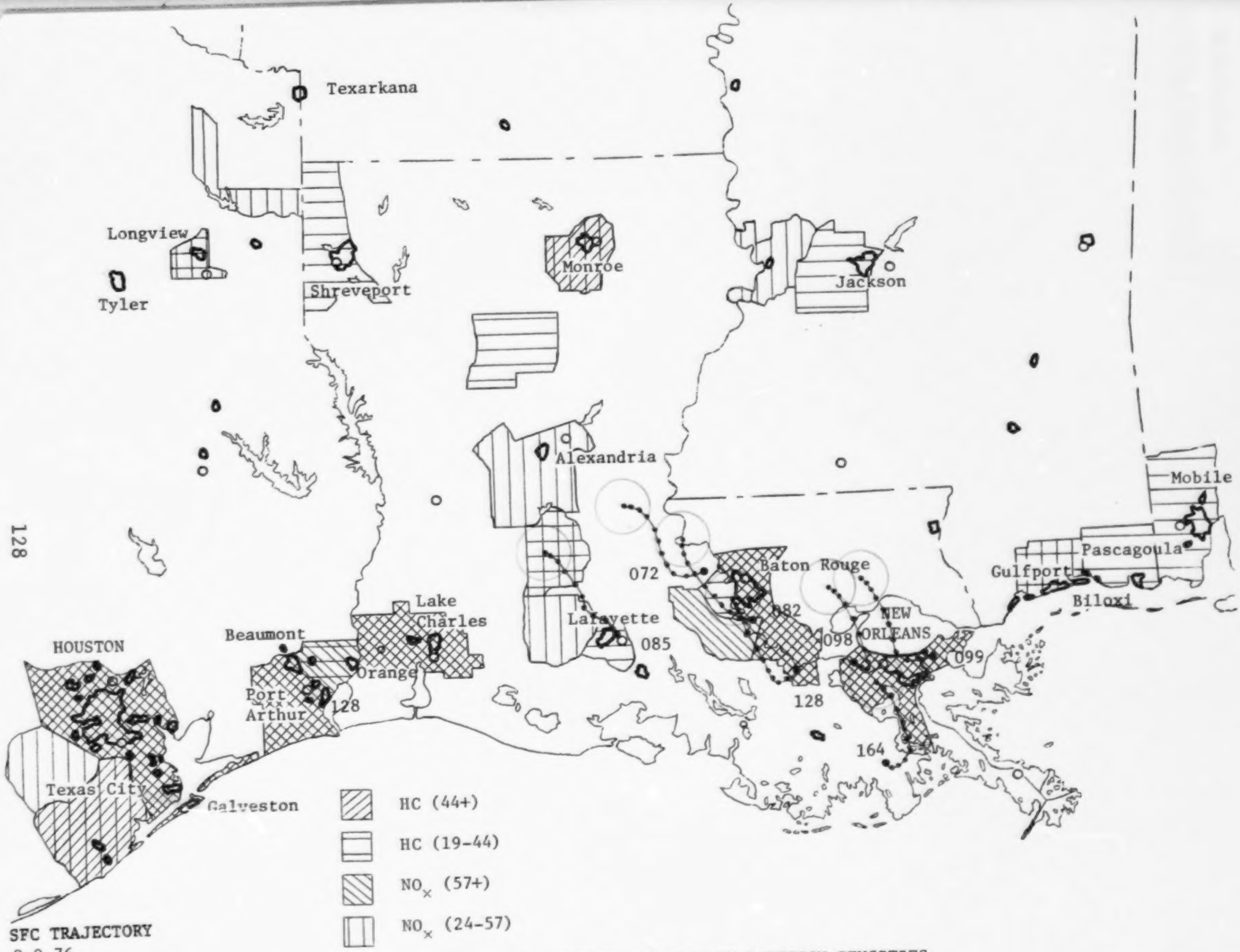
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
142
Lafayette
Lake Charles
Beaumont
Orange
Port Arthur
HOUSTON
Texas City
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NOx (57+)
▥ NOx (24-57)

SFC TRAJECTORY
9-9-76
6 am - 3 pm

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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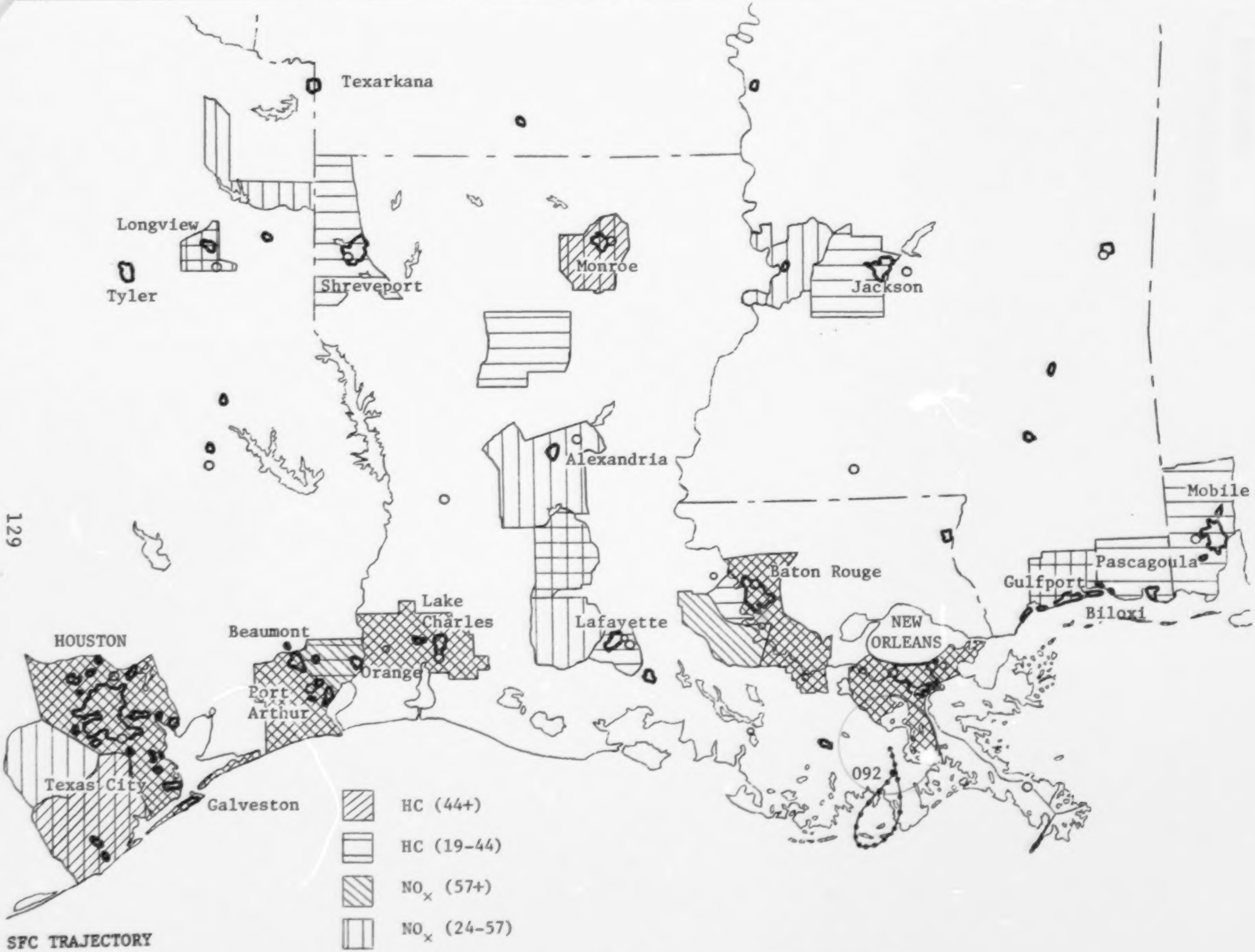
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
Lafayette
Lake Charles
Beaumont
Orange
Port Arthur
HOUSTON
Texas City
Galveston
072
082
085
098
099
128
128
164
▨ HC (44+)
▤ HC (19-44)
▧ NO$_x$ (57+)
▥ NO$_x$ (24-57)

SFC TRAJECTORY
9-9-76
6 am - 4 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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Shreveport
Monroe
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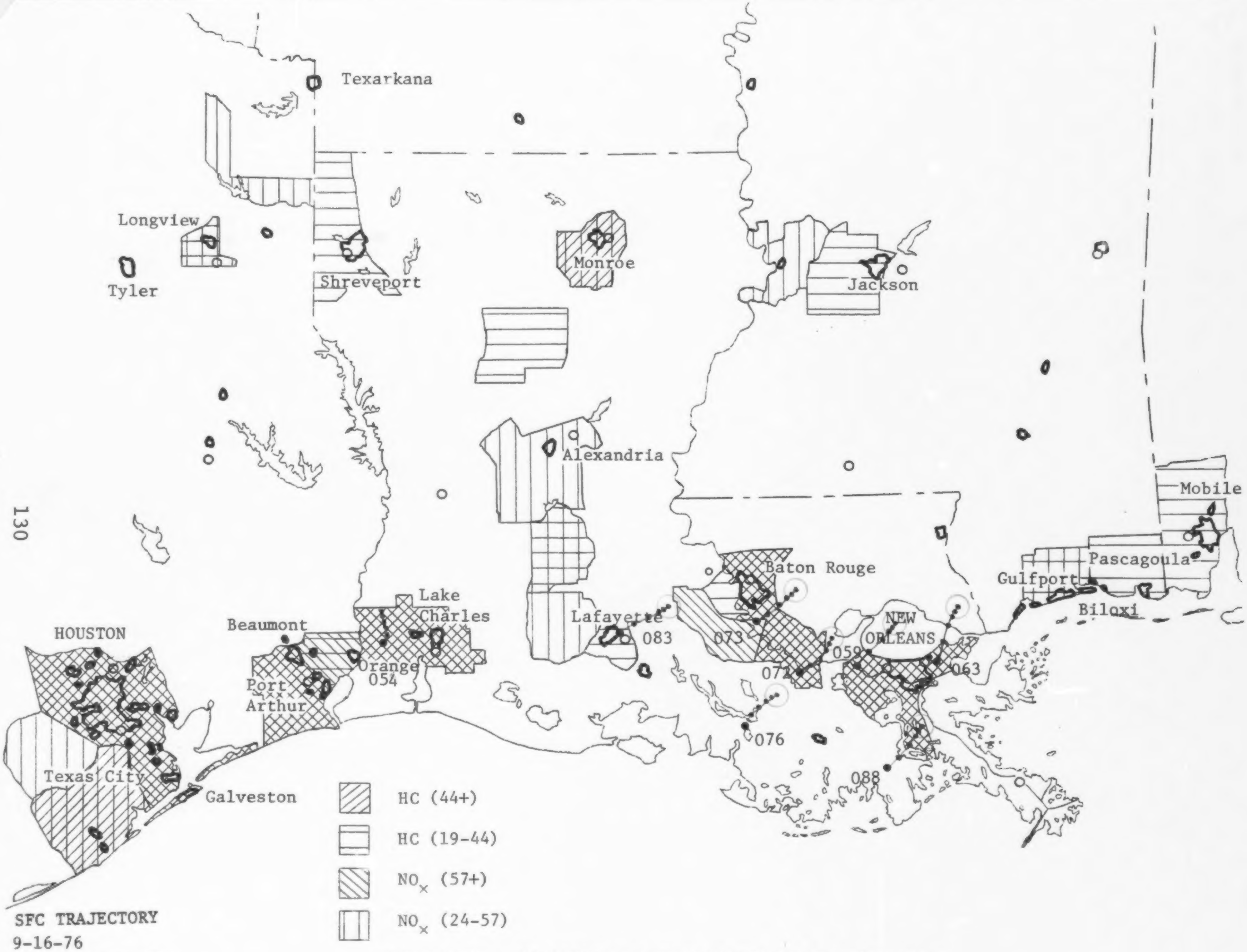
Alexandria
Mobile
Baton Rouge
Gulfport
Pascagoula
Biloxi
Lake Charles
Lafayette
NEW ORLEANS
HOUSTON
Beaumont
Orange
Port Arthur
Texas City
Galveston
092
▨ HC (44+)
▤ HC (19-44)
▧ NO_x (57+)
▥ NO_x (24-57)

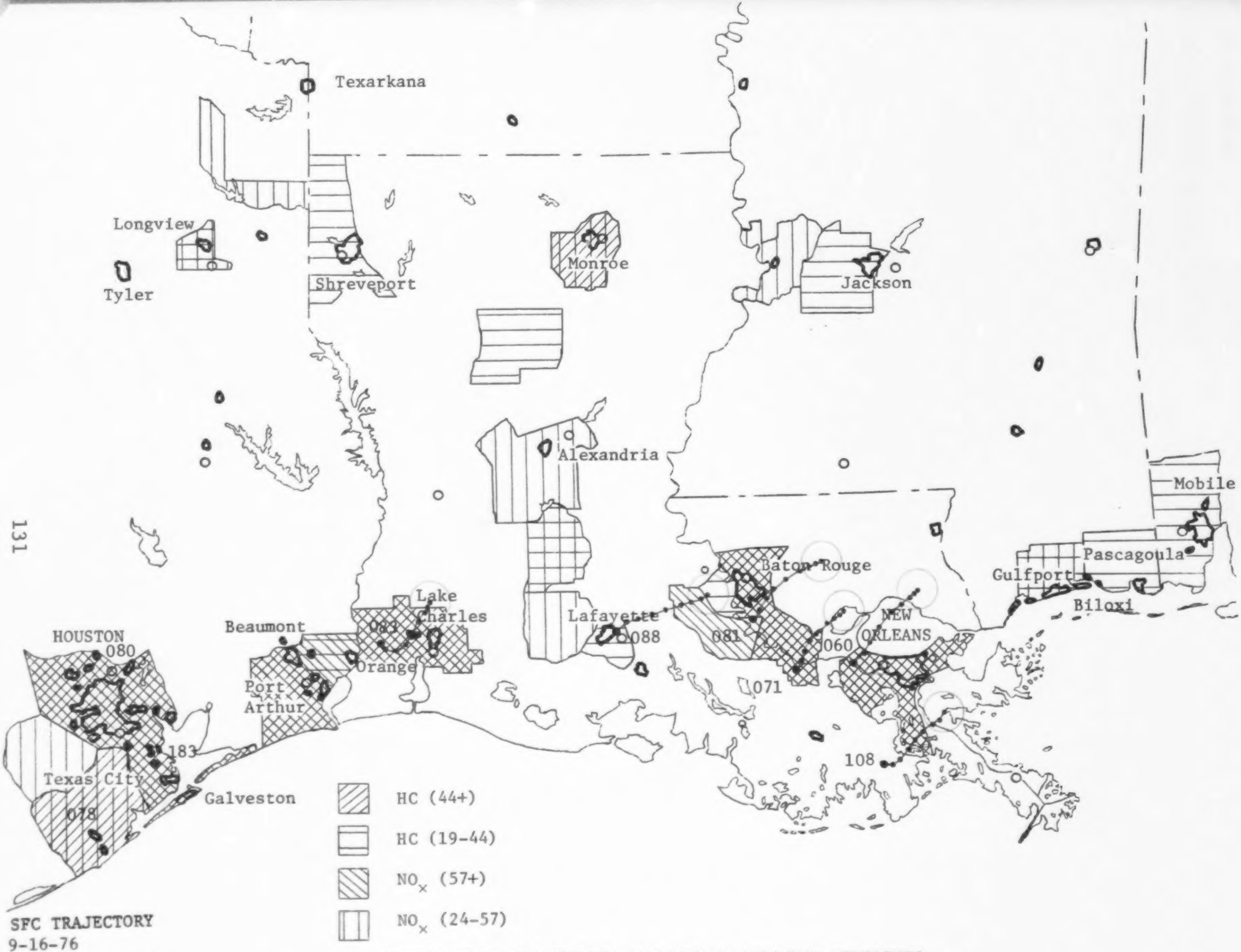
SFC TRAJECTORY
9-9-76
6 am - 11 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)


Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
063
059
072
073
083
Lafayette
076
088
Lake Charles
Orange
054
Beaumont
Port Arthur
HOUSTON
Texas City
Galveston
▨ HC (44+)
▤ HC (19-44)
▨ NO_x (57+)
▥ NO_x (24-57)

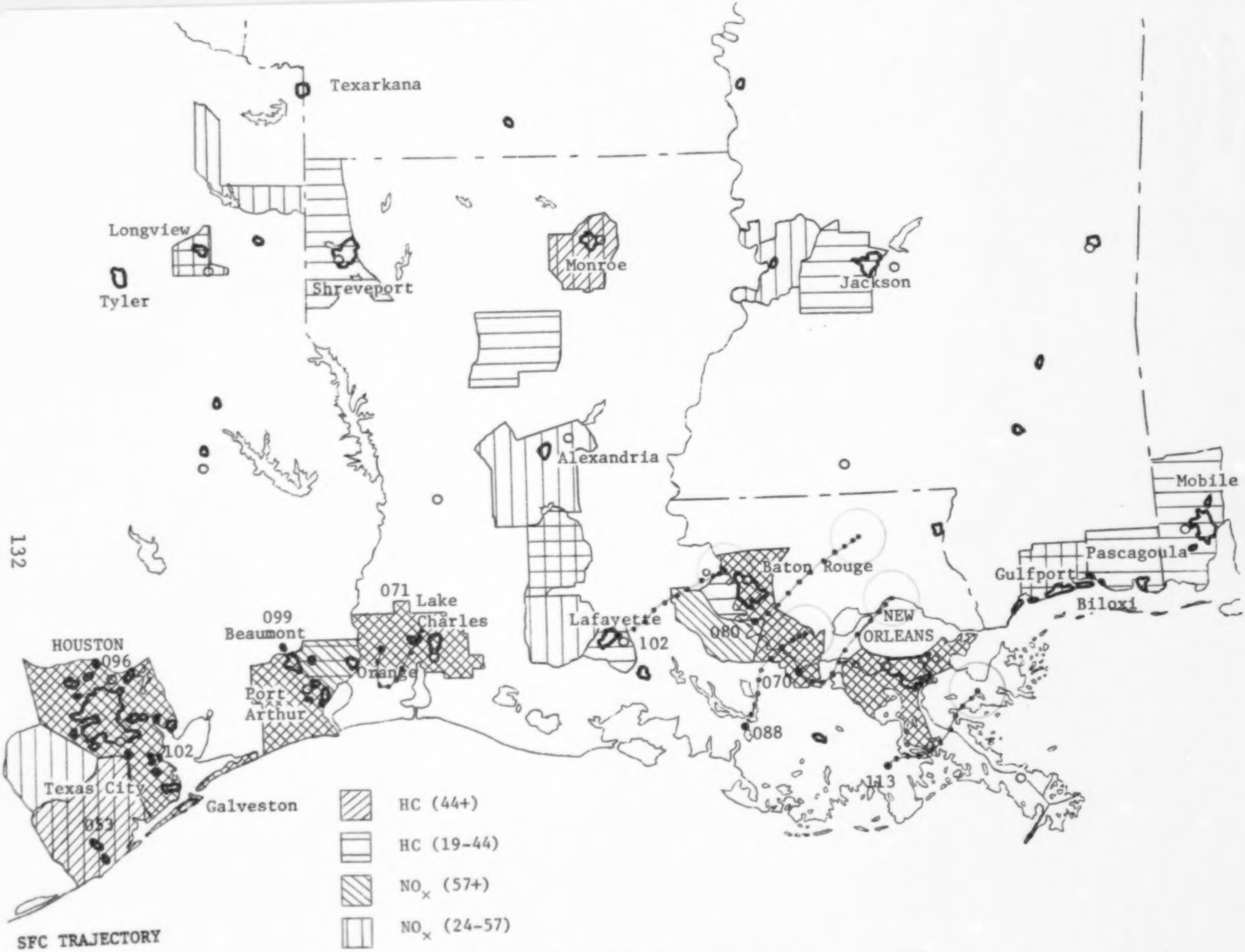
SFC TRAJECTORY
9-16-76
6 am - 11 am CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)


Texarkana
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
060
081
071
108
Lafayette
088
Lake Charles
083
Orange
Beaumont
Port Arthur
HOUSTON
080
183
Texas City
078
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NO$_x$ (57+)
▥ NO$_x$ (24-57)

SFC TRAJECTORY
9-16-76
6 am - 2 pm CDT

HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)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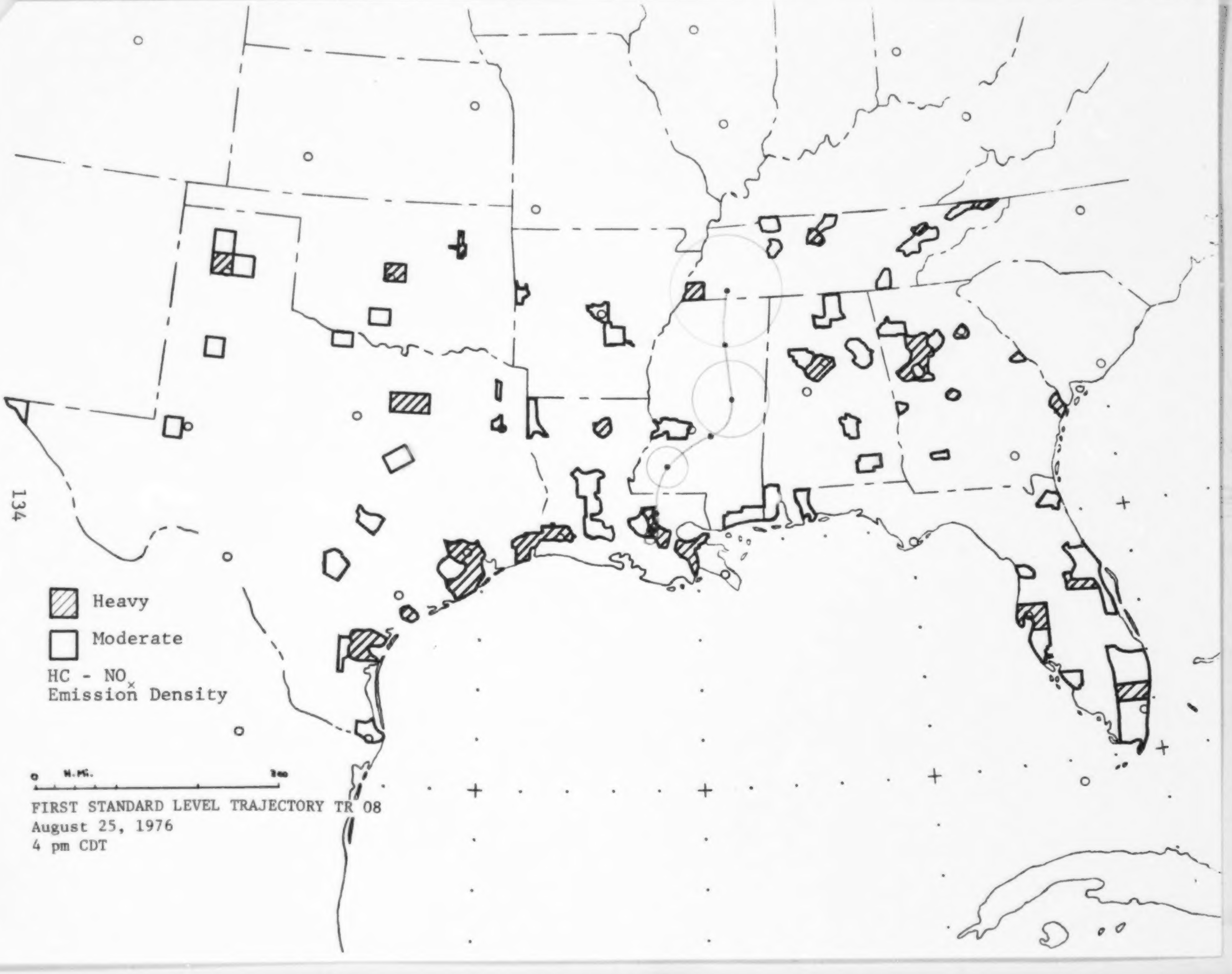
Longview
Tyler
Shreveport
Monroe
Jackson
Alexandria
Mobile
Pascagoula
Gulfport
Biloxi
Baton Rouge
NEW ORLEANS
Lafayette
102
080
070
088
113
071
Lake Charles
099
Beaumont
Orange
Port Arthur
HOUSTON
096
102
Texas City
053
Galveston
▨ HC (44+)
▤ HC (19-44)
▧ NO_x (57+)
▥ NO_x (24-57)

SFC TRAJECTORY
9-16-76
6 am - 4 pm CDT

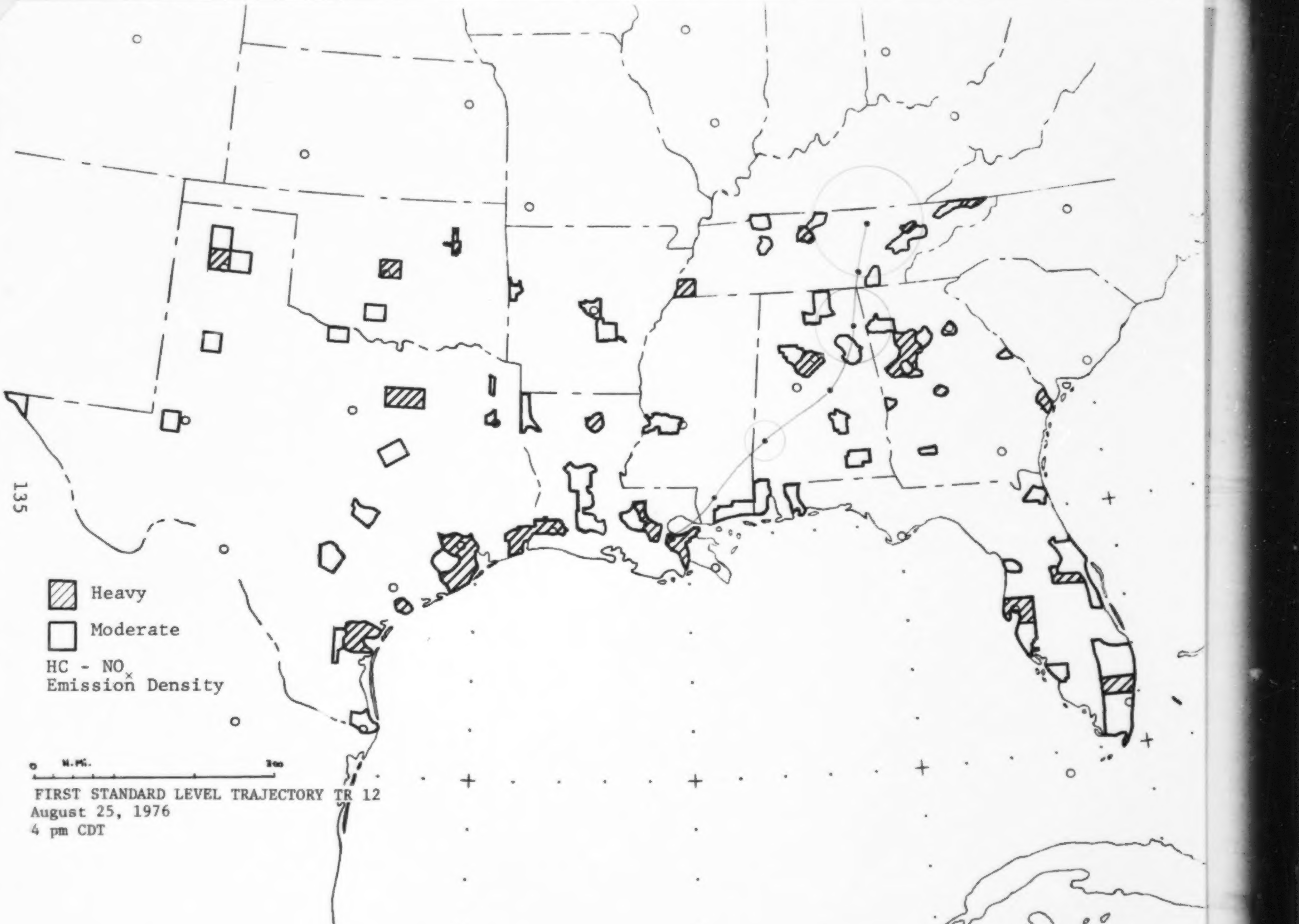
HYDROCARBON AND OXIDES OF NITROGEN EMISSION DENSITIES
(tons/sq.mi./yr.)

APPENDIX D

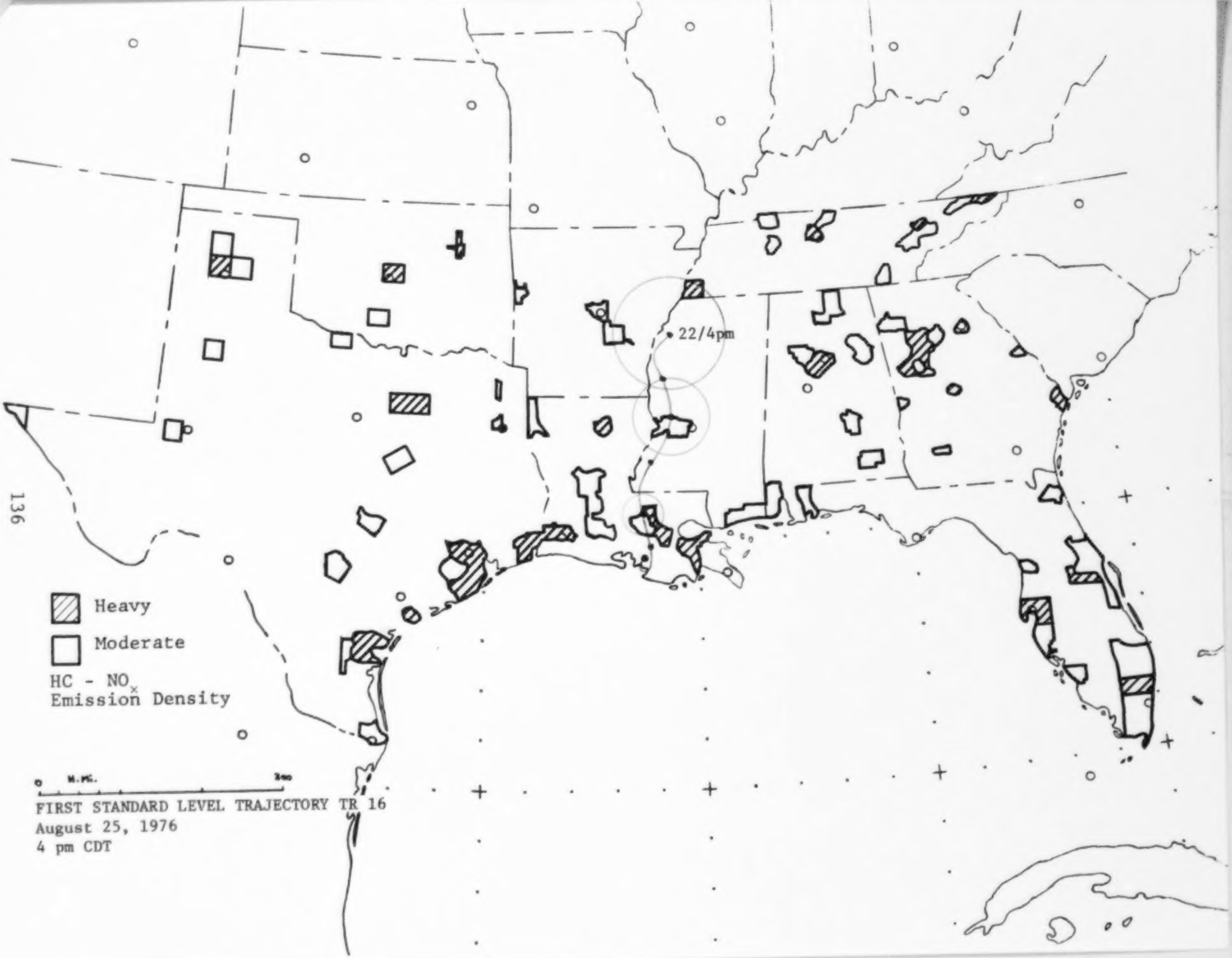
Appendix D consists of individual plots of first standard level trajectories derived by graphical method. Dots along the trajectory indicate positions at 12 hour intervals, with all trajectories running backwards in time. Circles at 24 hour intervals indicate an approximate error range based on ±1 mile for each hour duration. The trailer site and time of arrival of the air are given in the title. Approximate emission densities of hydrocarbons and oxides of nitrogen are shown by county on the base map, as obtained from EPA, state, and local air pollution agencies.


▨ Heavy
☐ Moderate
HC - NO_x
Emission Density
0 N.MI. 300

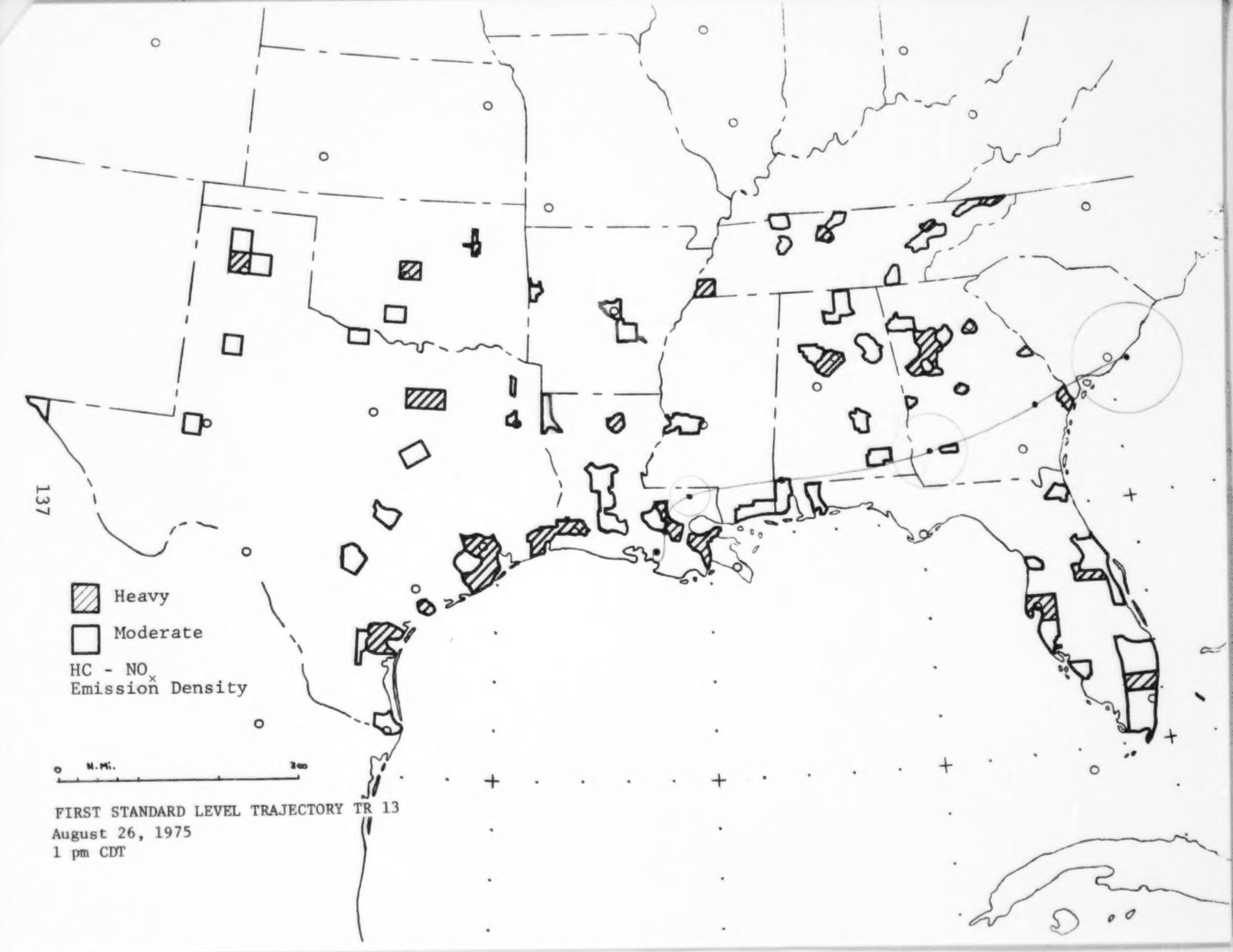
FIRST STANDARD LEVEL TRAJECTORY TR 08
August 25, 1976
4 pm CDT


Heavy
Moderate
HC - NO$_x$
Emission Density
0 N.MI. 200

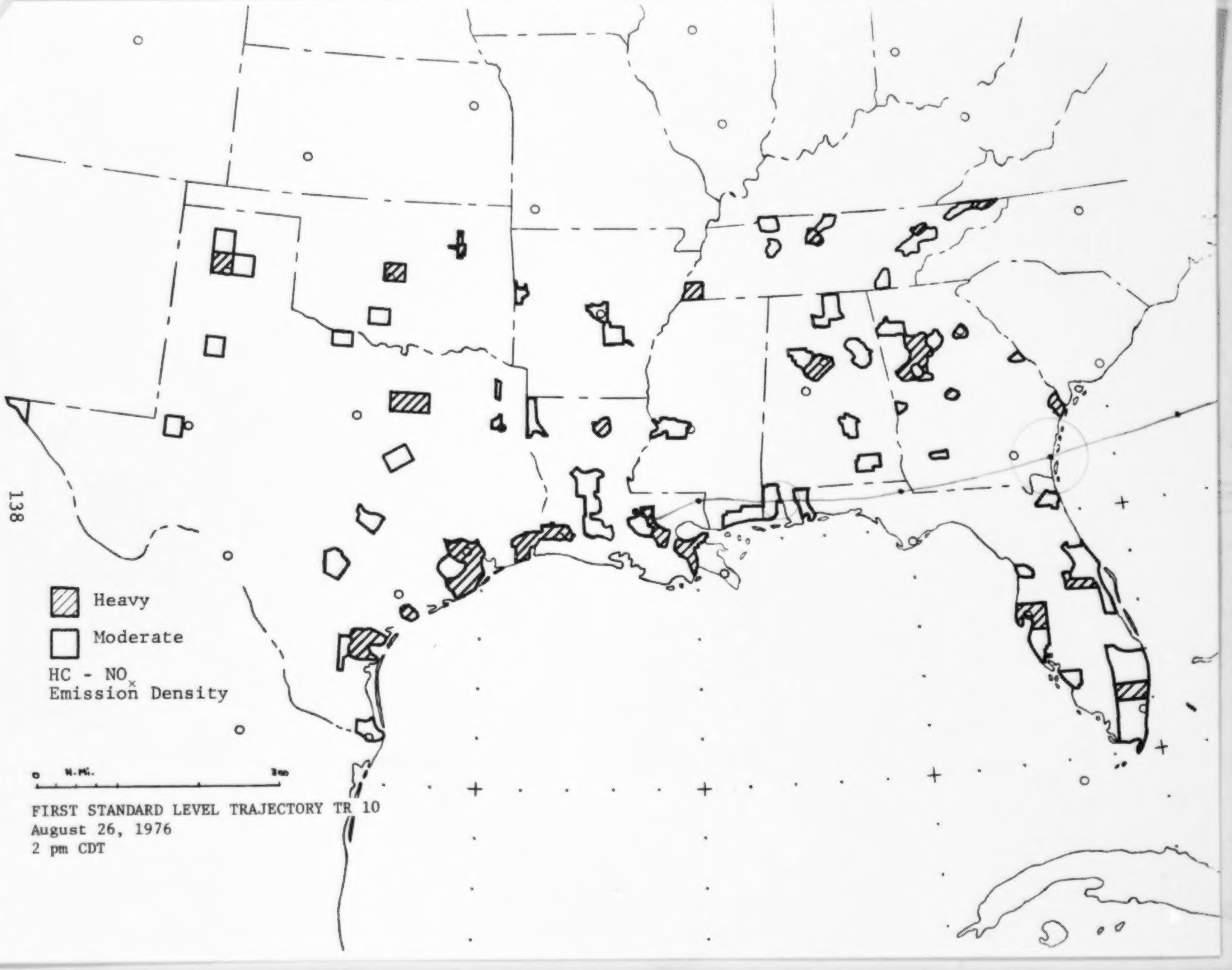
FIRST STANDARD LEVEL TRAJECTORY TR 12
August 25, 1976
4 pm CDT


22/4pm
Heavy
Moderate
HC - NO_x
Emission Density
0
N.MI.
300

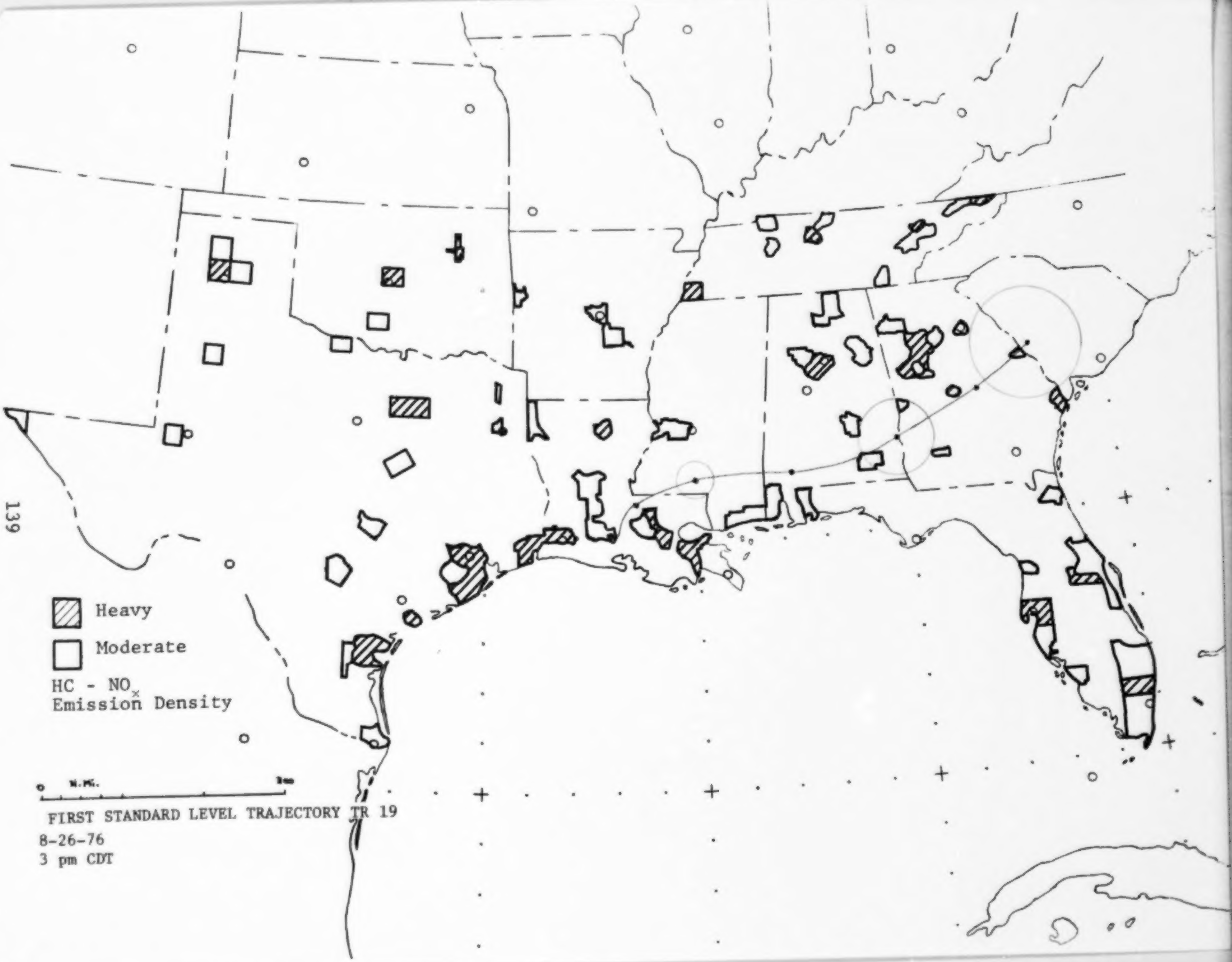
FIRST STANDARD LEVEL TRAJECTORY TR 16
August 25, 1976
4 pm CDT


Heavy
Moderate
HC - NO$_x$
Emission Density
0 N.Mi. 200

FIRST STANDARD LEVEL TRAJECTORY TR 13
August 26, 1975
1 pm CDT

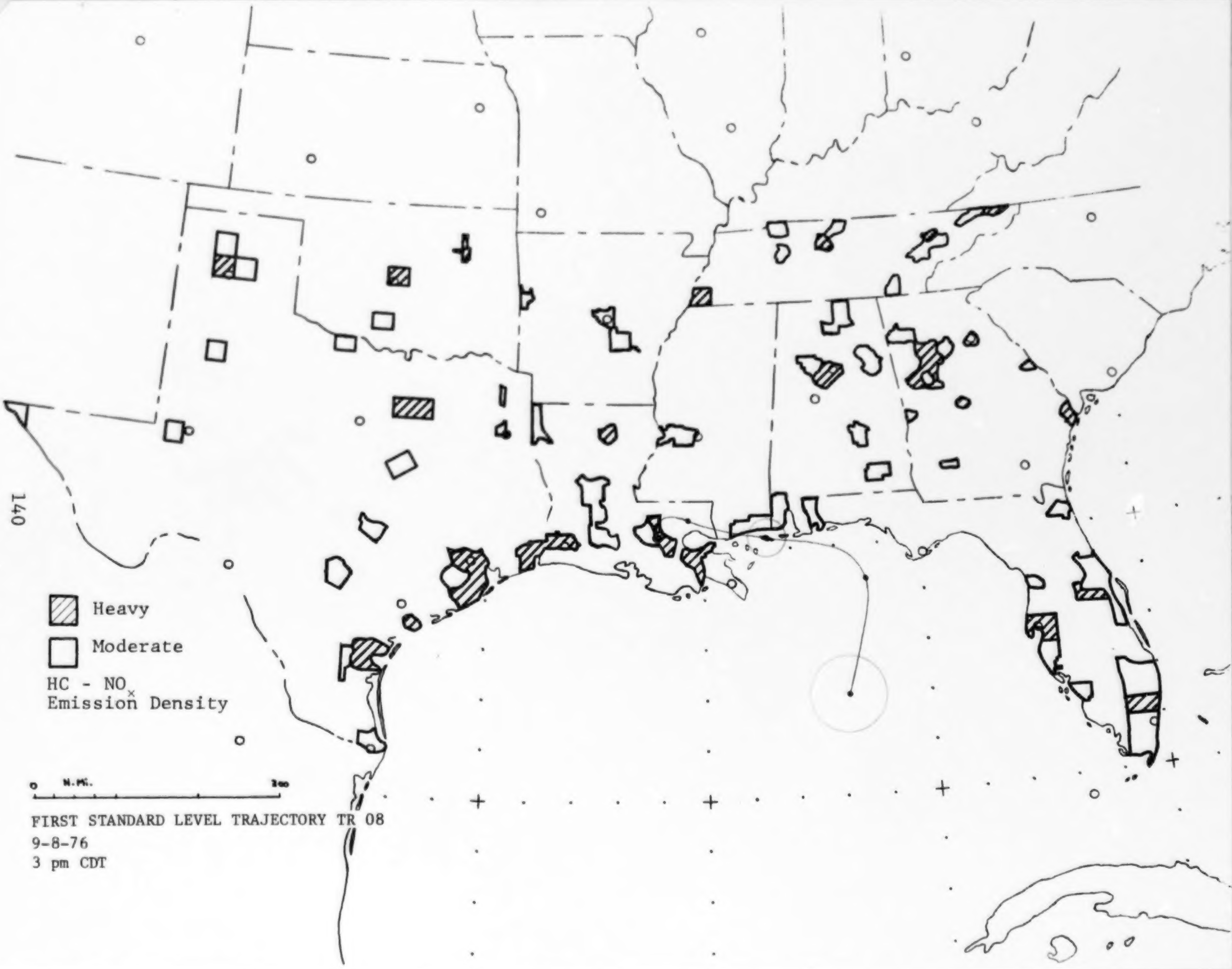

Heavy
Moderate
HC - NO$_x$
Emission Density
0 N.MI. 300

FIRST STANDARD LEVEL TRAJECTORY TR 10
August 26, 1976
2 pm CDT

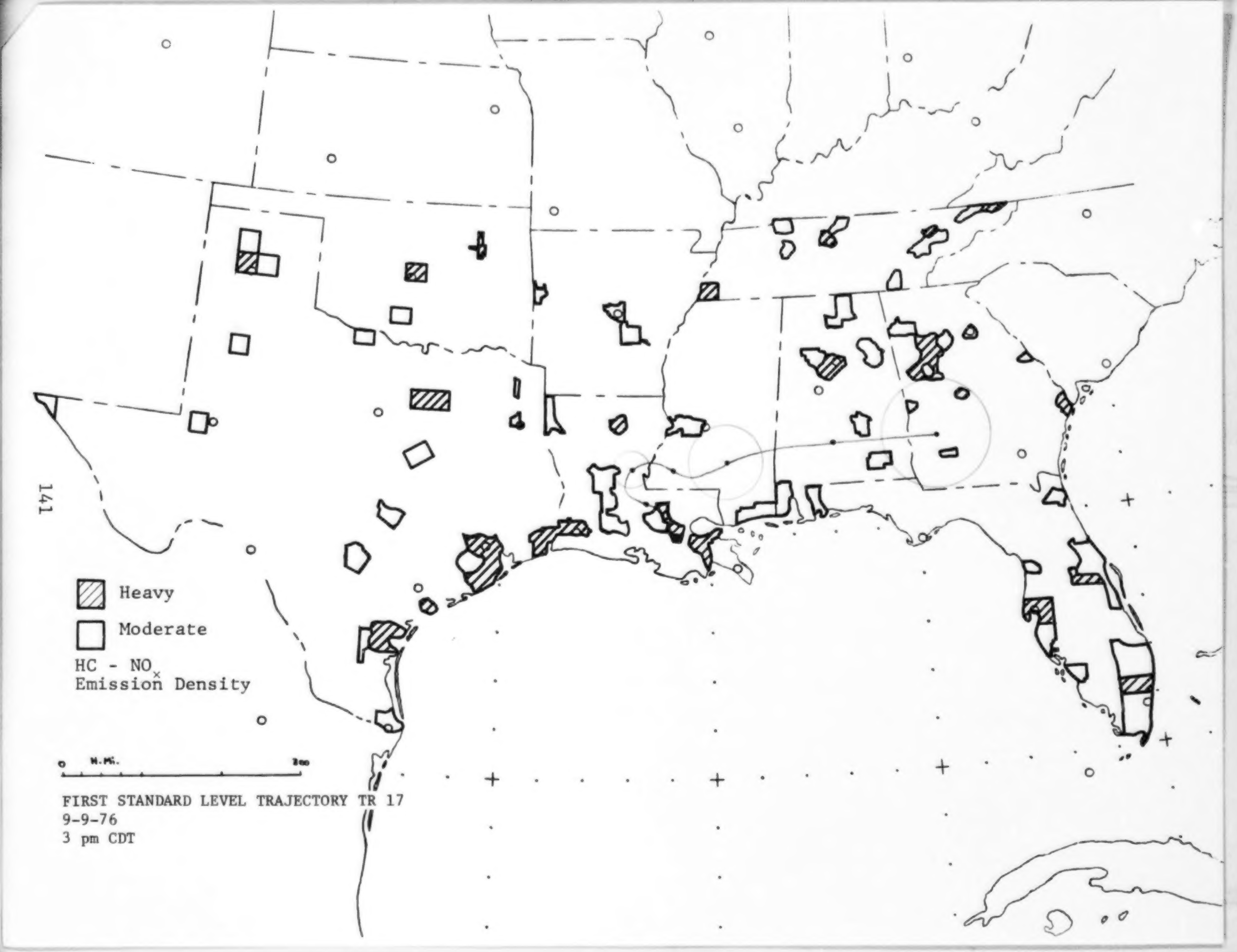

Heavy
Moderate
HC - NO$_x$
Emission Density
0 N.MI.

FIRST STANDARD LEVEL TRAJECTORY TR 19

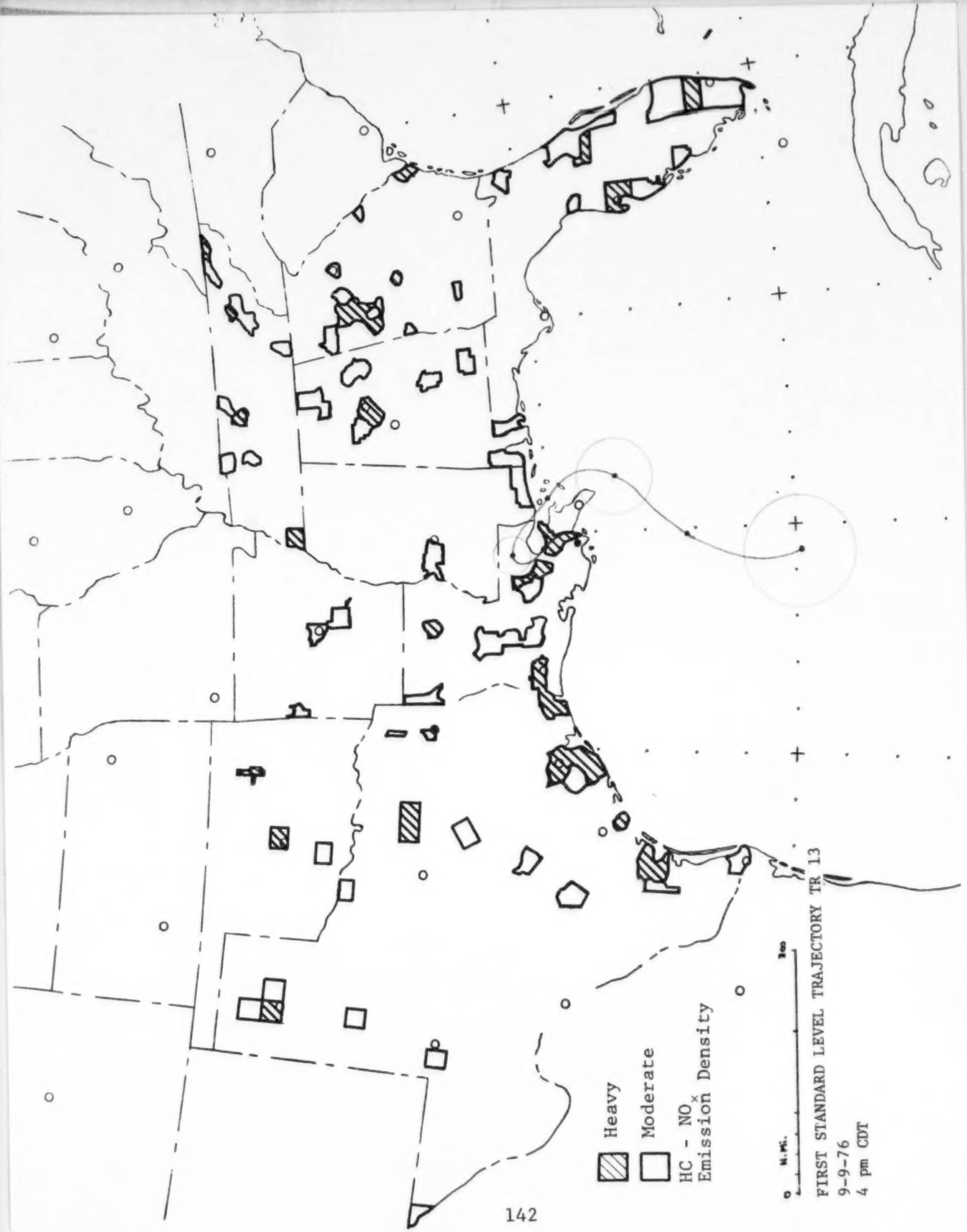
8-26-76
3 pm CDT


▨ Heavy
☐ Moderate
HC - NO$_x$
Emission Density
0 N.Mi. 300

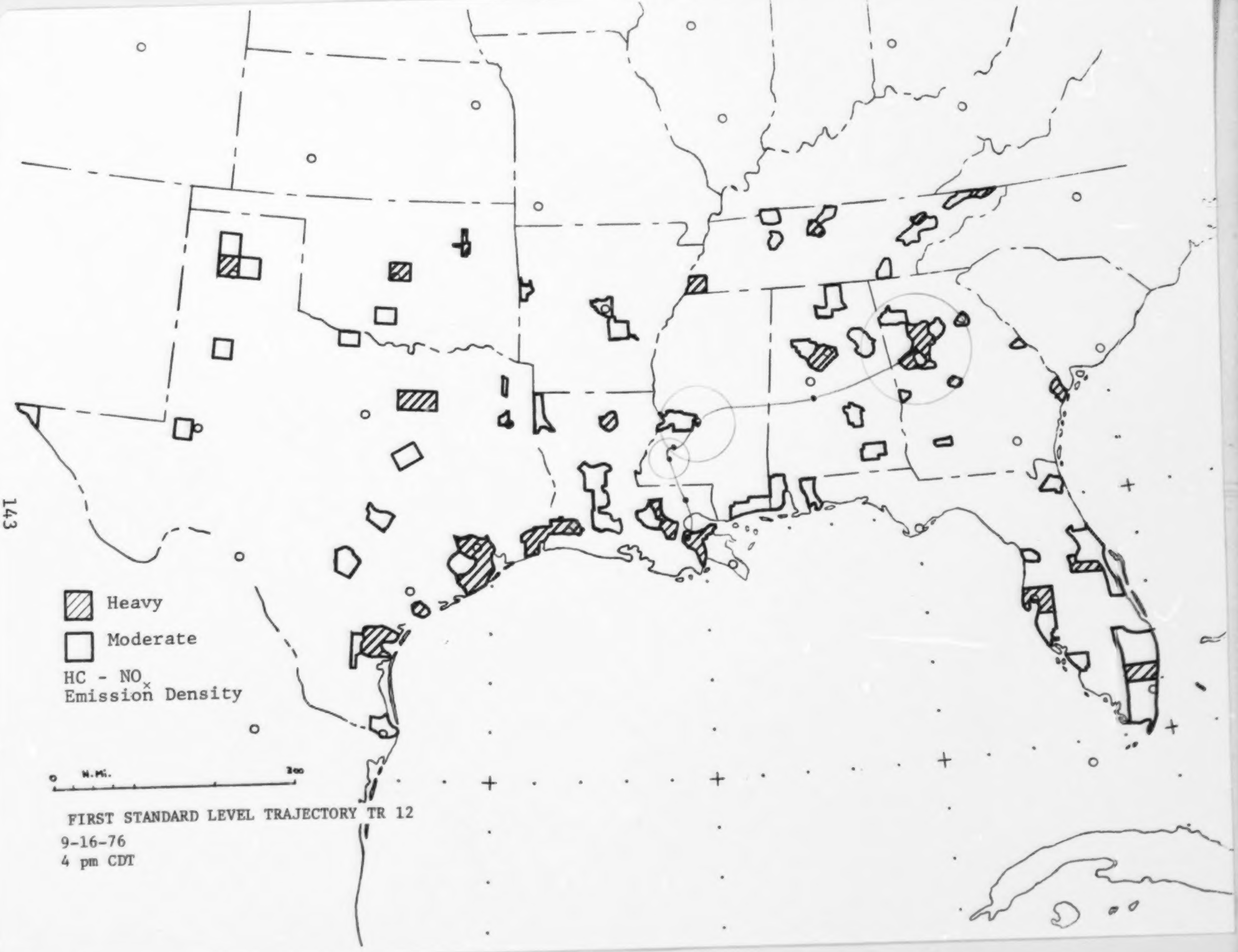
FIRST STANDARD LEVEL TRAJECTORY TR 08
9-8-76
3 pm CDT


▨ Heavy
☐ Moderate
HC - NO_x Emission Density
0 N.MI. 200

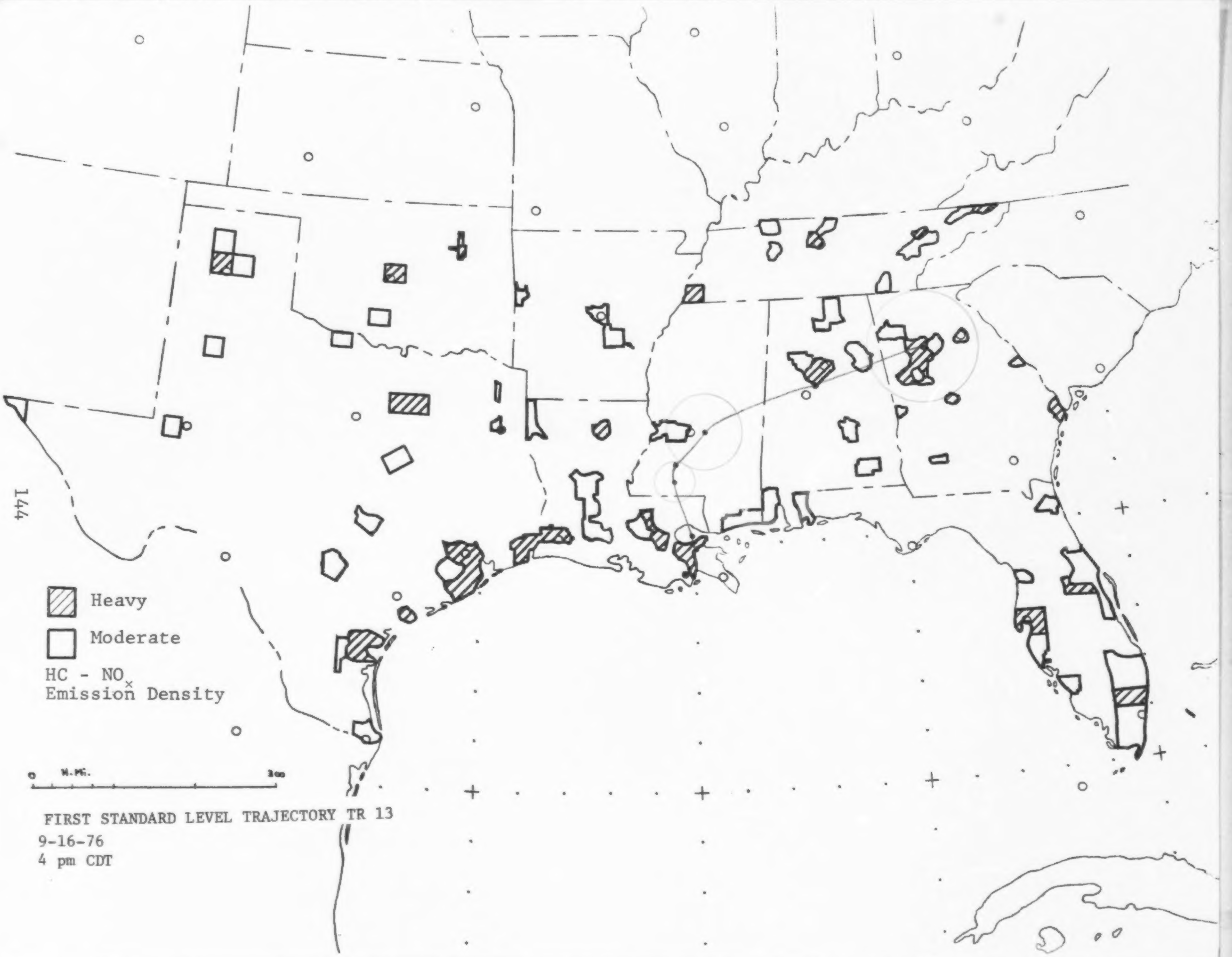
FIRST STANDARD LEVEL TRAJECTORY TR 17
9-9-76
3 pm CDT


▨ Heavy
☐ Moderate
HC - NO_x
Emission Density
0 N.MI. 100

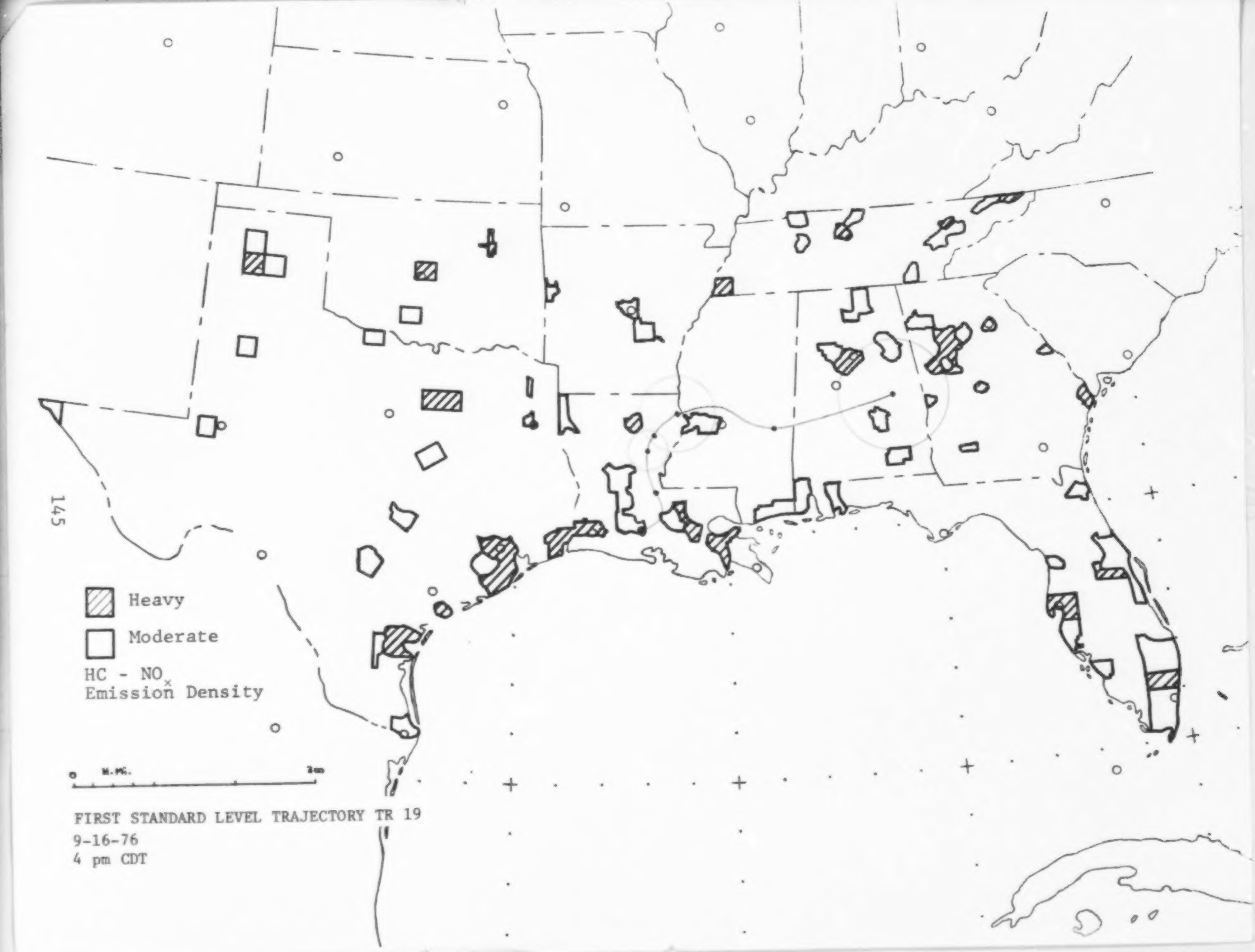
FIRST STANDARD LEVEL TRAJECTORY TR 13
9-9-76
4 pm CDT


Heavy
Moderate
HC - NO$_x$
Emission Density
0
N.Mi.
300

FIRST STANDARD LEVEL TRAJECTORY TR 12
9-16-76
4 pm CDT


▨ Heavy
☐ Moderate
HC - NO_x
Emission Density
0
N.Mi.
300

FIRST STANDARD LEVEL TRAJECTORY TR 13
9-16-76
4 pm CDT


Heavy
Moderate
HC - NO_x
Emission Density
0
N.Mi.
200

FIRST STANDARD LEVEL TRAJECTORY TR 19
9-16-76
4 pm CDT